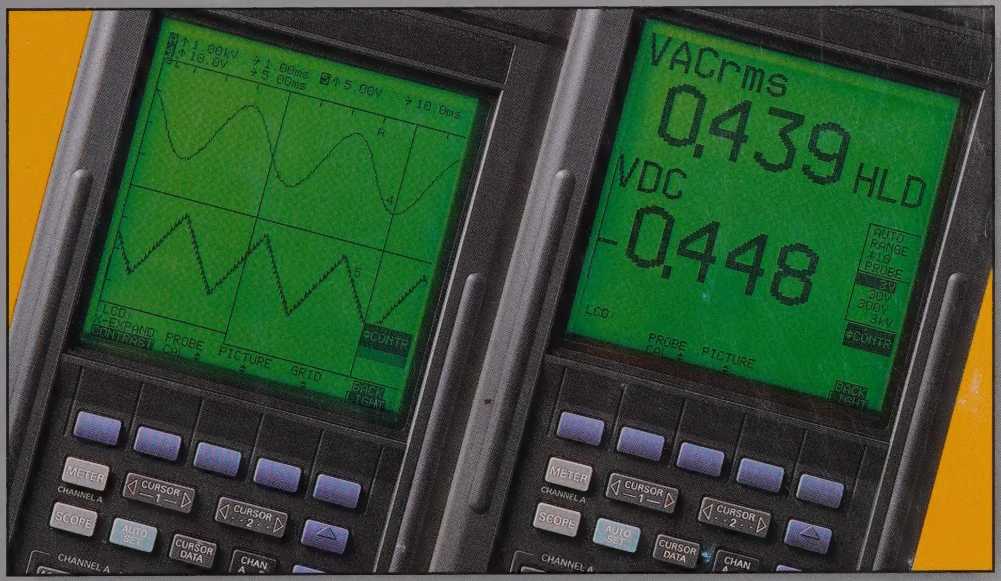
93/95/97 50MHz SCOPEMETER

USERS MANUAL



FLUKE®

0250

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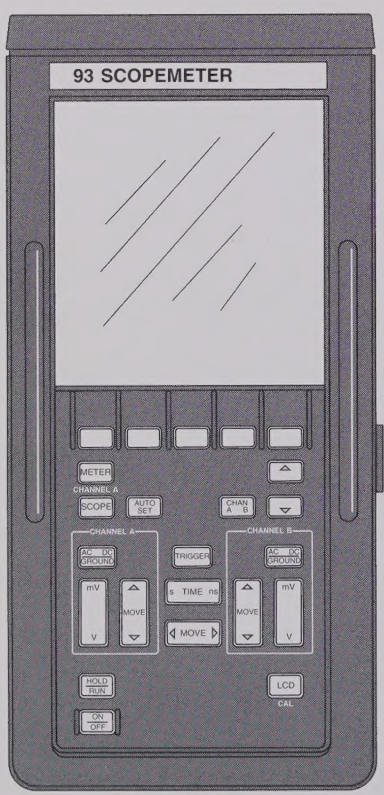
93 SCOPEMETER
METER
CHANNEL A
SCOPE
AUTO SET
CHAN A B
CHANNEL A
AC DC GROUND
TRIGGER
CHANNEL B
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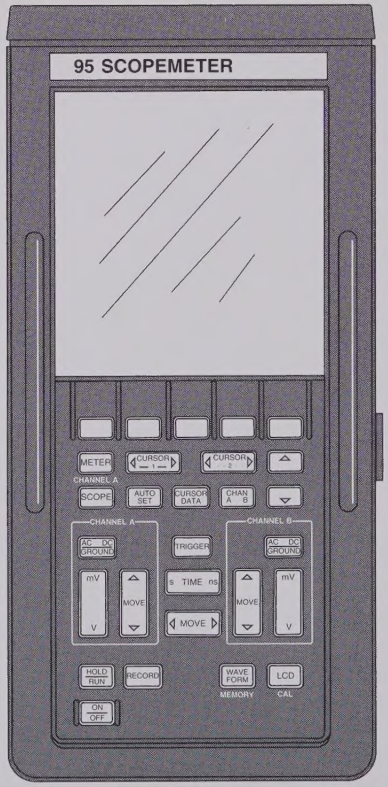
V
MOVE
s TIME ns
MOVE
MOVE
mV
V
HOLD RUN
LCD
CAL
ON OFF


95 SCOPEMETER
METER
CURSOR 1
CURSOR 2
CHANNEL A
SCOPE
AUTO SET
CURSOR DATA
CHAN A B
CHANNEL A
AC DC GROUND
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CHANNEL B
AC DC GROUND
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RECORD
WAVE FORM
MEMORY
LCD
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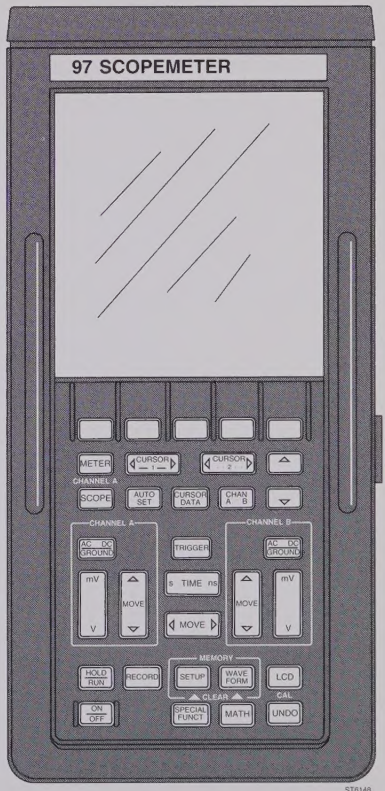
ON OFF


97 SCOPEMETER
METER
CURSOR 1
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CURSOR DATA
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AC DC GROUND
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mV
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MEMORY
HOLD RUN
RECORD
SETUP
WAVE FORM
LCD
CLEAR
CAL
ON OFF
SPECIAL FUNCT
MATH
UNDO

ST6148

FLUKE AND PHILIPS - THE GLOBAL ALLIANCE IN TEST & MEASUREMENT

93/95/97 50MHz SCOPEMETER

USERS MANUAL

Philips 4822 872 00496
Fluke 916119
920120

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SERVICE PARTS

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P.O. Box C 9090
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PM93,95,97 USER MANUAL ENGLISH
CUST. P.O. 528-92W040N

PHILIPS-PART-NO 4822-872-00496

Refer to Section 3 QUICK OPERATION

S = SCOPE
M = METER

93 | 95 | 97 | page 3-3, 3-7 | SM
METER and SCOPE

93 | 95 | 97 | page 3-8 | SM
AUTOSET

93 | 95 | 97 | page 3-4, 3-10 | SM
mV
V

93 | 95 | 97 | page 3-8 | SM
MOVE

93 | 95 | 97 | page 3-5, 3-9 | SM
HOLD/RUN

X | 95 | 97 | page 3-6,3-11 | SM
RECORD

93 | 95 | 97 | page 3-4, 3-8 | SM
s TIME ns

X | X | 97 | page 3-13 | SM
SETUP

X | X | 97 | page 3-16 | SM
UNDO

MAT4037

X | 95 | 97 | page 3-11 | S
WAVEFORM

93 | 95 | 97 | page 3-7 | S
CHAN AB

93 | 95 | 97 | SM
Blue softkeys

X | 95 | 97 | page 3-10 | S
CURSOR DATA

X | 95 | 97 | page 3-11 | S
CURSOR 1
CURSOR 2

93 | 95 | 97 | page 3-16 | SM

93 | 95 | 97 | page 3-4, 3-8 | SM
AC/DC/GND

93 | 95 | 97 | page 3-15 | SM
LCD/CAL

X | X | 97 | page 3-12 | S
MATH

X | X | 97 | page 3-14 | SM
SPECIAL FUNCT

93 | 95 | 97 | page 3-9 | S
TRIGGER

TERMINAL ARRANGEMENTS

RED BNC page 3-1

SCOPE CHANNEL A signal input

METER high voltage input

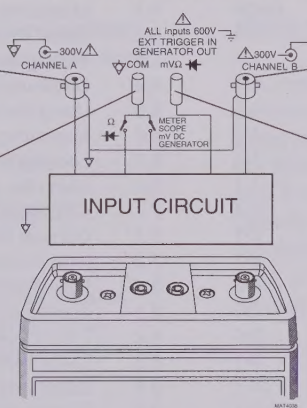
BLACK BANANA JACK page 3-1

SCOPE external trigger common input

METER mV DC common input

Ω, ⊣⊢ diode } - socket

GENERATOR (97 only) generator common output



GREY BNC page 3-1

SCOPE CHANNEL B signal input

RED BANANA JACK page 3-1

SCOPE external trigger input

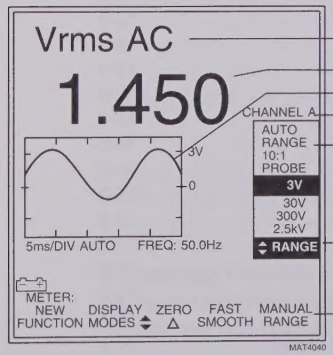
METER mV DC input

Ω socket, ⊣⊢ diode } + input

PROBE calibration output

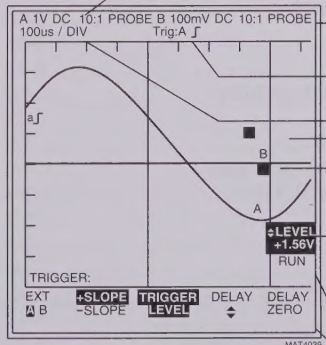
GENERATOR (97 only) generator output signal

Meter mode display (example)



- Meter mode setting
- Meter reading
- Scope trace
- Input terminal
- Selection menu
  Activate highlighted item with softkey
  Select item to highlight with the
  Up Down keys
- Information about function of
  Up Down keys
- Actual softkey functions

Scope mode display (example)



- Channel A attenuator and probe settings
- Channel B attenuator and probe settings
- Trigger information (source, slope, delay)
- Timebase setting
- Oscilloscope signal display
- Trace identification A, B, ■ Ground identification
- Adjust menu
  Highlighted item can be adjusted with the
  Up Down keys
- Acquisition information
- Actual softkey functions

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12 Index 12-1

IMPORTANT: In correspondence concerning this instrument, please give the model number, the code number, and serial number as located on the instrument.

For your reference:	Model number:	Fluke --
	Code number:	---- --- -----
	Serial number:	DM -- ----

NOTE
The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.

HOW TO ORDER THE SERVICE MANUAL

For complete procedures for maintenance, service, performance verification, and calibration adjustments, order the Service Manual for the ScopeMeter Models 93, 95, 97 (Order number 915970).
In U.S.A., call 1-800-526-4731.
Outside the U.S.A., contact your nearest Fluke/Philips representative.
A list of service centers is provided at the end of this manual.

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UNPACKING

The following items should be included in the shipment:

- 1 ScopeMeter
- 1 PM8918/002 Probeset
- 1 Probe accessory set
- 1 Multimeter test lead set
- 1 PM9083/001 Holster
- 1 C75 Accessory case.
- 1 PM8907/00x Power adapter/battery charger.
- Users Manual
- Quick Operating Guide placed inside the holster.
- PM9086/001 NiCad Battery Pack placed inside the battery compartment.

INITIAL INSPECTION

Check the contents of the shipment for completeness and note whether any damage has occurred during shipment. If the contents are incomplete, or if there is damage to the instrument or its accessories, file a claim with the carrier immediately, and notify the FLUKE/PHILIPS sales or service office nearest you to facilitate the repair or replacement of the instrument or accessories.

NOTE
When new, the rechargeable battery pack is not fully charged. See page 4-1.

GENERAL

Thank you for purchasing this ScopeMeter. It has been designed and manufactured to the highest quality standards to give you many years of trouble-free and accurate measurements.

The ScopeMeter combines a DIGITAL STORAGE OSCILLOSCOPE and a DIGITAL MULTIMETER. In addition, it has a built-in SIGNAL GENERATOR. All this makes the ScopeMeter extremely useful for "on the go" service in workshops or in the lab.

This User Manual will help you to make optimum use of the ScopeMeter. This manual starts with a detailed description of the basic Model 93. Where applicable, additional functions of Model 95 and/or Model 97 are also described.

A "Quick Operating Guide", which you will find in the holster, provides you with a handy guide to the functions of Models 93, 95, and 97.

If you have any comments on how these products or manuals could be improved, contact your local Fluke/ Philips representative.

1.1 ATTENTION

Read this page carefully before beginning to use the instrument.

1.2 INTRODUCTION

The instrument described in this manual is designed to be used only by qualified personnel.

1.3 SAFETY PRECAUTIONS

For the correct and safe use of this instrument, it is essential that both operating and servicing personnel follow generally accepted safety procedures in addition to the safety precautions specified in this manual.
Specific warning and caution statements, where they apply, will be found throughout the manual.
Where necessary, the warning and caution statements and/or symbols are marked on the instrument.

1.4 CAUTION AND WARNING STATEMENTS

CAUTION
Is used to indicate correct operating or maintenance procedures in order to prevent damage to or destruction of the equipment or other property.

WARNING
Calls attention to a potential danger that requires correct procedures or practices in order to prevent personal injury.

1.5 SYMBOLS

Caution (refer to accompanying documents).

Common (Lo) input symbol, equipotentiality

High BNC input symbol.

Equipment protected throughout by DOUBLE INSULATION or REINFORCED INSULATION.

Earth.

Recycling symbol.

1.6 IMPAIRED SAFETY-PROTECTION

Use of equipment in a manner not specified may impair the protection provided by the equipment.
Before use, inspect probes for mechanical damage and replace damaged probes!
Whenever it is likely that safety has been impaired, the instrument must be turned off and disconnected from line power. The matter should then be referred to qualified personnel. Safety is likely to be impaired if, for example, the instrument fails to perform the intended measurements or shows visible damage.

2.1 GENERAL

Examine the ScopeMeter carefully to become familiar with the layout of the input terminals, pushbuttons, and display. Read the WARNING information on the rear panel. Charge battery pack before use.

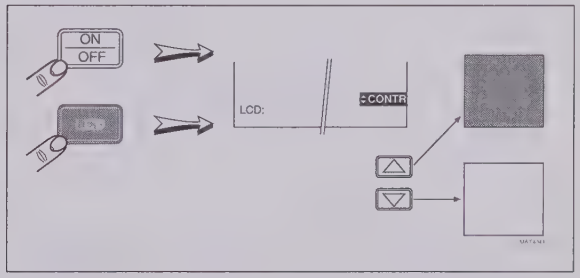
If you have used a Scope or Multimeter before, simply examining your ScopeMeter will probably give you a good idea of how to use it. The following procedure is an overview of how to take basic measurements.

Although this procedure will allow you to get started quickly making measurements via channel A (RED BNC), we suggest that you take the time to read the remainder of this manual so that you can learn how to take full advantage of your ScopeMeter's capabilities.

The front panel of the ScopeMeter has a number of keys that have direct access to functions: AC DC GROUND, mV V, MOVE, HOLD/RUN, s TIME ns, AUTOSET, ON/OFF, UNDO.
Other keys call up a menu displayed at the bottom end of the LCD (Liquid Crystal Display): SCOPE, METER, CHAN A B, TRIGGER, WAVEFORM etc.
In the menus, you use the blue softkeys to select the functions. If functions are marked with ⇳, they will call up a pop-up menu from which you make a selection with the blue Up Down keys [△] [▽].
Once you make a selection from a pop-up menu (visible in reverse video), you press the ENTER softkey to activate the function. In some pop-up menus more than one function can be selected before the pop-up menu disappears. When a function is selected, it is indicated by a big dot in the pop-up menu.

2.2 CONTRAST ADJUSTMENT OF THE DISPLAY

1. Press the **ON/OFF** key to turn on the ScopeMeter.
2. Press the Up Down keys [△] or [▽] to adjust the contrast of the LCD to your preference.



NOTE
The contrast adjustment level of the LCD is stored in the ScopeMeter memory until a new adjustment is made.

To adjust the contrast during normal operation, just press the **LCD** key, then press the Up Down keys [△] or [▽] again.

2.3 QUICK SCOPE OPERATION VIA CHANNEL A (RED)

For quick operation, all models of the ScopeMeter are equipped with an AUTOSET function. This function sets the parameters of the scope (attenuator, time base and trigger source) for an optimum trace.

Perform the following steps for quick scope operation:

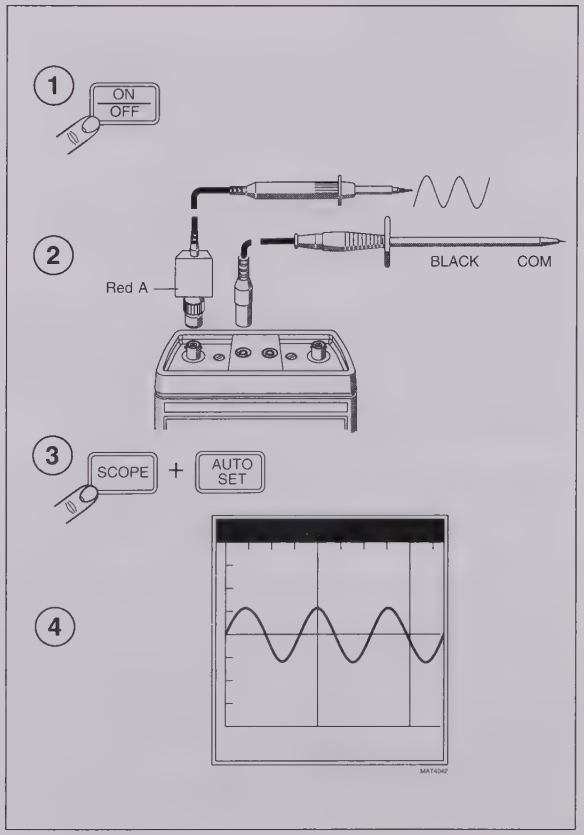
1. Press the **ON/OFF** key to turn on the ScopeMeter.
2. Connect a signal via the RED scope probe to channel A.
3. Press the **SCOPE** key to turn on the SCOPE mode and press the **AUTOSET** key to select the AUTOSET function.
4. Observe that an image of the signal supplied to channel A appears on the display. The top of the display shows the attenuator, probe, timebase, and trigger information.

NOTE

For manual selection of attenuator, time base and trigger functions, refer to section 5 "EXPLANATION OF THE SCOPEMETER FUNCTIONS".

WARNING

TO AVOID ELECTRICAL SHOCK OR DAMAGE TO THE SCOPEMETER, DO NOT APPLY MORE THAN 600V BETWEEN THE SCOPE PROBE AND COMMON ( ), OR MORE THAN 300V DIRECTLY BETWEEN CHANNEL "A" ( ) AND COMMON ( ).



2.4 QUICK MULTIMETER OPERATION VIA CHANNEL A (RED)

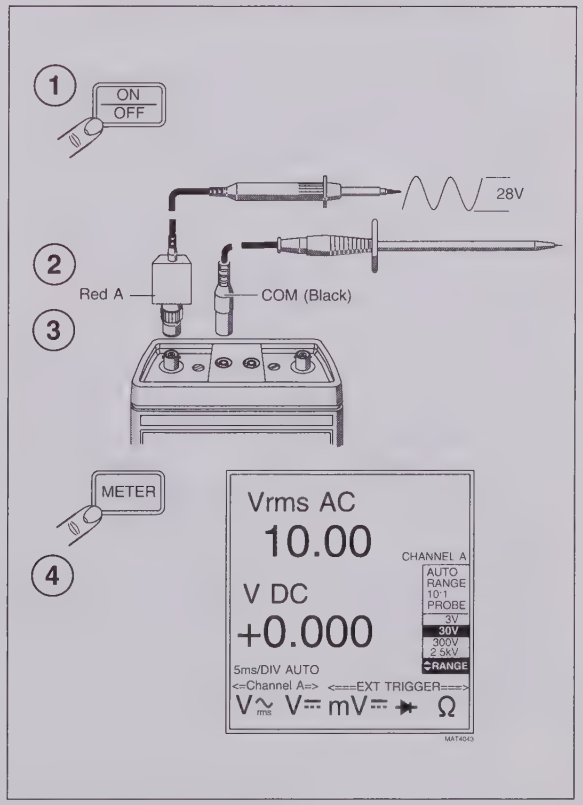
The ScopeMeter has a Multimeter mode that can be used, for example, to accurately measure the scope signal shown in the illustration.

Perform the following steps for quick multimeter operation:

1. Press the **ON/OFF** key to turn on the ScopeMeter.
2. Connect a signal via the RED scope probe to channel A, e.g. 1 kHz, 28V p-p sinewave.
3. Press the **METER** key to turn on the METER mode.
4. The ScopeMeter automatically returns to its initial settings:
   Input: Channel A
   Function: VOLTS with separated ac and dc components of the input signal.
   Ranging: Automatic (including 10:1 probe)
   Display: Vrms AC and V DC

NOTE For selection of other multimeter functions, refer to section 5 "EXPLANATION OF THE SCOPEMETER FUNCTIONS".

WARNING
TO AVOID ELECTRICAL SHOCK OR DAMAGE TO THE SCOPEMETER, DO NOT APPLY MORE THAN 600V BETWEEN THE SCOPE PROBE AND COMMON (⏚) OR MORE THAN 300V DIRECTLY BETWEEN CHANNEL "A" (⊙) AND COMMON (⏚).

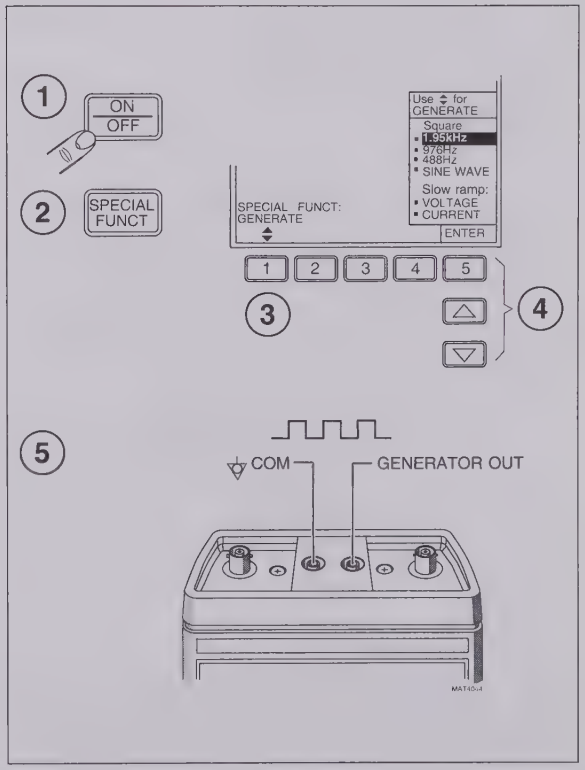


2.5 QUICK SIGNAL GENERATOR OPERATION (Model 97)

The Model 97 ScopeMeter has a signal generator mode. The signal generator allows the user to generate a number of pulse patterns that can be used as stimulus signals.

Perform the following steps for quick signal generator operation:

1. Press the **ON/OFF** key to turn on the ScopeMeter.
2. Press the **SPECIAL FUNCT** key to turn on the SPECIAL FUNCTions.
3. Select the GENERATE function.
   On the display the GENERATE pop-up menu shows a number of signals that can be generated.
4. Use the [△] or [▽] key to set the pop-up pointer to the desired signal.
   Press ENTER to activate the selected signal.
   For turning off the entered signal proceed as follows:
   Select the GENERATE function. Use the [△] [▽] Up Down keys to set the pop-up pointer to the activated signal. Press ENTER.
5. The generated signal is available on the GENERATOR OUTput.



3.1 GENERAL

This section describes your ScopeMeter and how to get started quickly.

NOTE
To meet the full users specifications, it is essential that only probes calibrated on the instrument are used. Refer to section 4 "INSTALLATION INSTRUCTIONS" for probe calibration.

3.2 SCOPEMETER

INPUT/OUTPUT TERMINALS ARRANGEMENT SCOPEMETER

The ScopeMeter has two BNC safety inputs and two safety banana jack inputs. Depending on the main function used (Scope, Meter, or Signal Generator) the inputs are rearranged. The following overview shows the input arrangement.

Symbols used: COMMON,

HIGH BNC INPUT,

EARTH.

Used as SCOPE:

Channel A, Channel B. 300V

Maximum input voltage	Signal voltage (via 10:1 probe delivered with the ScopeMeter)	300V rms
		600V rms
	Voltage to earth	600V rms
Input impedance	Direct	1 MΩ//25 pF
	(via 10:1 probe delivered with the ScopeMeter)	10 MΩ//15 pF
Input coupling	AC/DC/GND	

External trigger input.

Maximum input voltage	Signal voltage	300V rms
	Voltage to earth	600V rms
Input impedance		1 MΩ//25 pF
Trigger level		TTL compatible

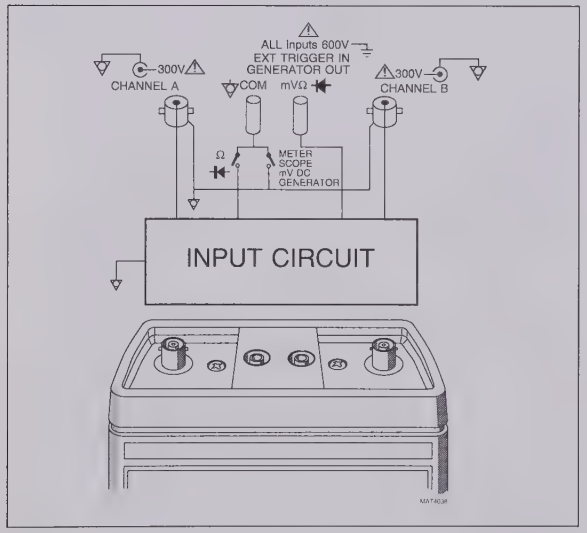
Used as METER:

Channel A = High voltage input. 300V

Functions Vrms AC and V DC.

Ranges 300 mV, 3V, 30V, 300V (250V Vrms AC).

Maximum input voltage	Signal voltage (via 10:1 probe delivered with the ScopeMeter)	300V rms
	Voltage to earth	600V rms



mV Ω = Low voltage input.

Function mV DC, Ranges 300 mV, 3V.

Maximum input voltage	Signal voltage	300V rms
	Voltage to ground	600V rms

Function DIODE, Range 2.8V, measuring current 0.5 mA.

Function Ω, Ranges 300Ω, 3 kΩ, 30 kΩ, 300 kΩ, 3 MΩ, 30 MΩ.

Used as SIGNAL GENERATOR: (Model 97)

Generator output:	Square wave, Sine wave
	Slow ramp current
	Slow ramp voltage

TURNING ON THE SCOPEMETER

1. Insert the test leads or probe into the appropriate input terminals.
2. Press the **ON/OFF** key to turn on the ScopeMeter. The ScopeMeter turns on after about 1 second as indicated by a beeper signal. At turn on, the ScopeMeter returns to the previous selected function before turn off.
3. To select a function, press the appropriate keys.

NOTE
At turn on battery power POWER *or* ADAPTER POWER *is displayed to indicate the power source.*

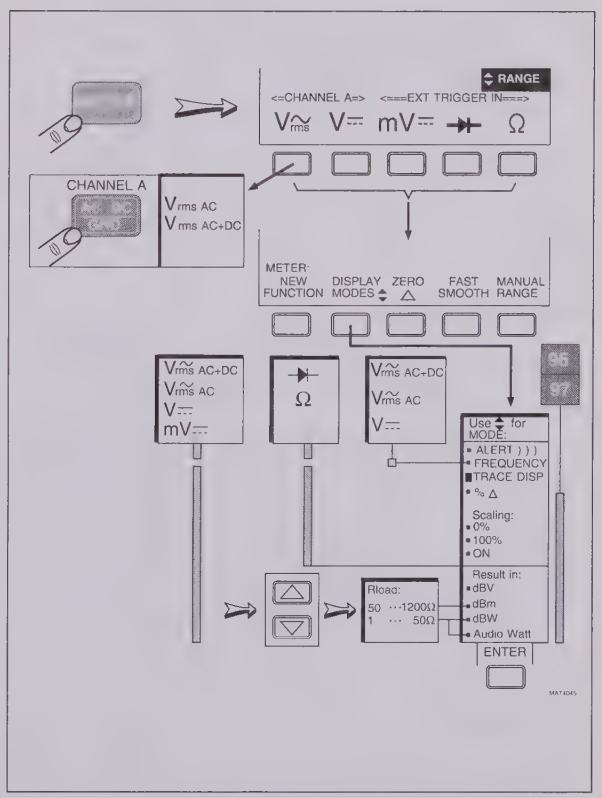
3.3 METER

METER FUNCTIONS

1. Press the **METER** key.
   The meter is automatically set to the combined function Vrms AC/V DC to measure both the AC and DC part of the signal supplied to CHANNEL A.
   The meter ranging is set to AUTO RANGE of the timebase and the attenuator.
2. Press one of the blue softkeys to select a new meter function.
   Press the **AC/DC/GND** key to select between ac-coupled input (VACrms)and or dc-coupled input (VrmsAC+DC) in the V ∿ rms function.

   NOTE
   When using a single function, the measurement is displayed as a numeric reading and a SCOPE trace. Functions V ∿ rms and V ⎓ use the Channel A terminal. Functions mV ⎓ , ⊣⊢ and Ω use the mV, Ω, ⊣⊢ banana jack, and common banana jack.

3. Press one of the blue softkeys in a specific function to:
   - Select a **NEW METER FUNCTION**.
   - Select the **DISPLAY MODES** pop-up menu to select additional features and modes.
   - Select the **ZERO** △ function (relative reference).
   - Select the **SMOOTH** or **FAST** result display function.
   - Select the **MANUAL RANGE** function.



METER RANGES

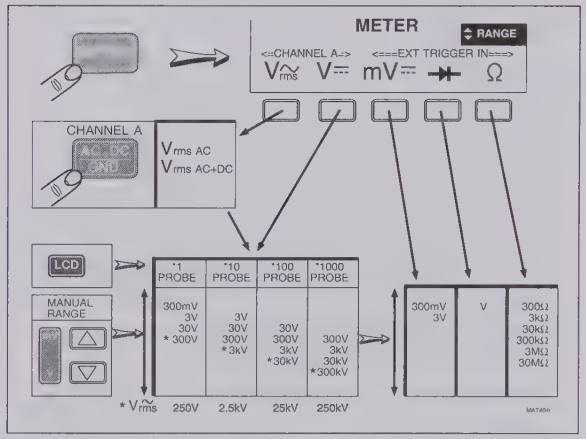
1. Press the **METER** key.
   The meter is automatically set to the combined function Vrms AC/V DC to measure the AC and the DC part of the signal supplied to CHANNEL A.
   The meter ranging is set to AUTO RANGE of the timebase and the attenuator.
2. Press one of the blue softkeys to select a new meter function.

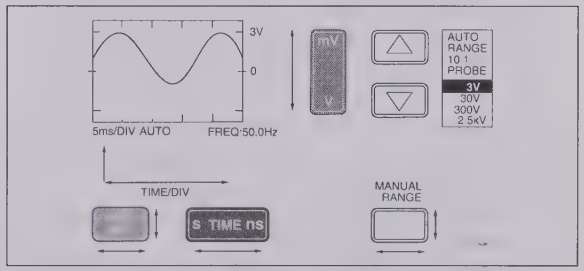
MANUAL RANGE

3. Press the **MANUAL RANGE** softkey to enter the manual ranging mode for the timebase and the attenuator.
4. Select the desired attenuator range with the ⏶ ⏷ Up Down keys or with the **mV V** attenuator key of channel A. The ScopeMeter automatically switches to the manual attenuator ranging mode if the ⏶ ⏷ Up Down keys or the **mV V** key are pressed.
5. Select the desired timebase range with the **s TIME ns** key. The ScopeMeter automatically switches to the manual timebase ranging mode if the **s TIME ns** key is pressed.

AUTO RANGE

6. Press the **AUTO SET** key or the **AUTO RANGE** softkey or select a new meter function for automatic setting of the timebase and the attenuator.





NOTE In the function mV ⎓ , and Ω the timebase range is 5 ms/DIVision FIXED. In the function ⊣⊢ the timebase range is 5 ms/Division FIXED and the attenuator range is 3V.

METER TOUCH HOLD® FUNCTION

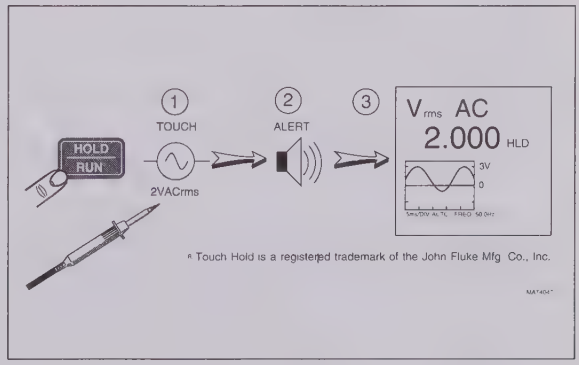
1. Press the **HOLD/RUN** key and measure the wanted signal.
   In the display the Touch Hold function is indicated by HLD.
2. Wait until the meter produces a beeper signal to indicate a stable signal.
3. Remove the measuring leads and read the result from the display.
4. Measure a new signal, wait for the beeper, remove the leads, and read again.

® Touch Hold is a registered trademark of the John Fluke Mfg. Co., Inc.

NOTE
The combined initial Vrms AC/V DC function, the FREQUENCY function, the SMOOTH and FAST function, and the RECORD function (Model 95 and 97) are excluded from Touch Hold.

METER DISPLAY HOLD IN Vrms AC/V DC, FREQUENCY, AND RECORD MODE (Models 95 and 97)

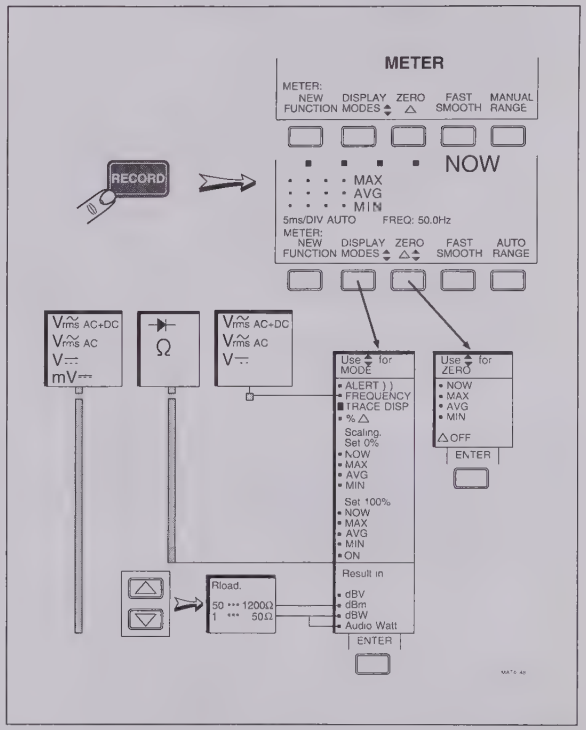
1. Press the **HOLD/RUN** key to freeze the display
   - Hold is indicated with HLD in reverse video on the display.
2. Press the **HOLD/RUN** key for a new display result.



METER RECORD MODELS 95 and 97

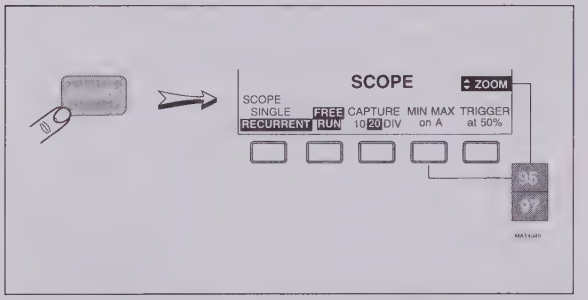
1. Press the **RECORD** key.
   The MAXimum, AVG (average) and MINimum values are recorded from the measured input signal.
   The maximum, average, and minimum values are shown at the bottom of the display.
   The present actual measurement result is shown in the main display with the indication NOW appearing behind the reading.
2. Press one of the blue softkeys in a specific function to:
   - Select a **NEW** specific **METER** function.
   - Select the **DISPLAY MODES** pop-up menu to select additional features and modes.
   - Select the **ZERO** △ pop-up menu (relative reference).
   - Select the **SMOOTH/FAST** result display function.
   - Select the **MANUAL RANGE** mode of the timebase and attenuator.

   NOTE
   Changes in the MAXimum and MINimum values are indicated by the beeper.



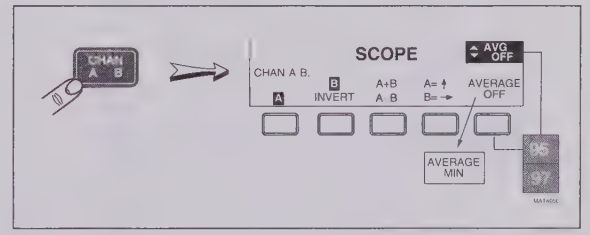
3.4 SCOPE

SCOPE ACQUISITION MODES



1. Press the **SCOPE** key.
   The scope is initially set to the **RECURRENT** mode.
2. Press one of the blue softkeys to:
   - Select the **SINGLE** trigger mode or the **RECURRENT** mode.
   - Select the **FREE RUN** trigger mode.
   - Select the **CAPTURE 10 20 DIV** mode, to capture acquisitions in 10 or 20 divisions.
   - Select the **MIN MAX on A** mode, (Models 95 and 97).
   - Select the set **TRIGGER level at 50%** mode.
3. Press the [△] Up key to **ZOOM** in on the signal, or the [▽] Down key to **ZOOM** out (Models 95 and 97).

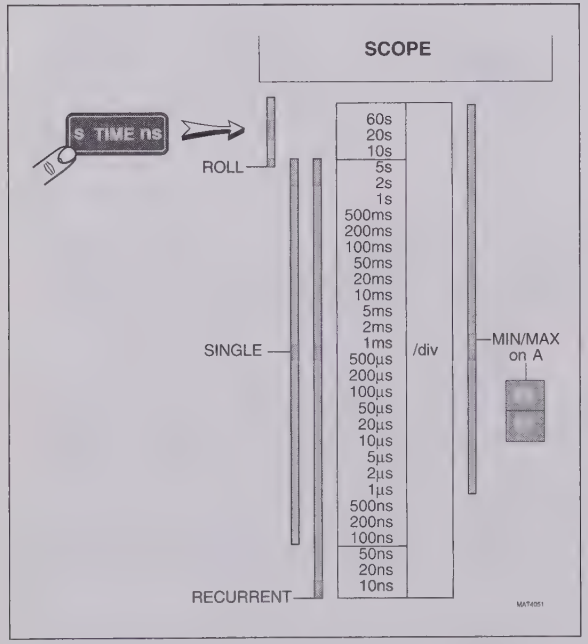
CHANNEL A B



1. Press the **CHAN A B** key.
   The scope is set to the channel selection mode.
2. Press one of the blue softkeys to:
   - Select channel **A** on/off.
   - Select channel **B** on/off or **INVERT**.
   - Select the basic mathematics mode, add channel **A+B**, subtract channel **A-B**.
   - Select the channel A versus channel B mode **A=** ↑ **B=** →.
   - Select the **AVERAGE OFF** mode, (Models 95 and 97). Press the [△] [▽] Up Down keys to set the average mode and number of averages.

   NOTE
   AVERAGE OFF changes into AVERAGE MIN in the 1 mV and 2 mV attenuator ranges for models 95 and 97.

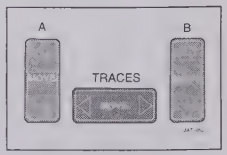
TIMEBASE



1. Press the **s TIME ns** key to step through the timebase range.
   The selected timebase setting is shown in the display heading.
   The timebase range depends on the selected trigger function (SINGLE or RECURRENT).
   Press the **SCOPE** key to enter the SINGLE or RECURRENT trigger function.

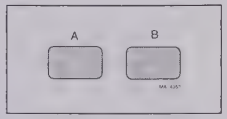
   NOTE The ROLL mode is automatically selected at a timebase ≥10 seconds/division.
2. Press the **SCOPE** key to enter the **MIN/MAX on A** detect function. The MIN/MAX detect function is available in Models 95 and 97.

TRACE MOVEMENT



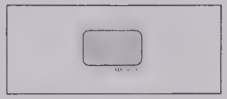
1. Press the **MOVE** keys to position the traces to almost any display position.

CHANNEL INPUT COUPLING (AC/DC/GND)



1. Press the **AC/DC/GND** key of the corresponding channels A or B to AC-couple, DC-couple, or GROUND a channel.

AUTOSET



1. Press the **AUTOSET** key to automatically select the optimum settings for applied signals.

HOLD/RUN and SINGLE ACQUISITION

HOLD/RUN acquisition

1. Press the **SCOPE** key.
2. Select the **RECURRENT** mode.
3. Press the **HOLD**/RUN key to hold the acquisition. A flashing HOLD on the display indicates the hold mode.
4. Press the HOLD/**RUN** to re-enable the acquisition.

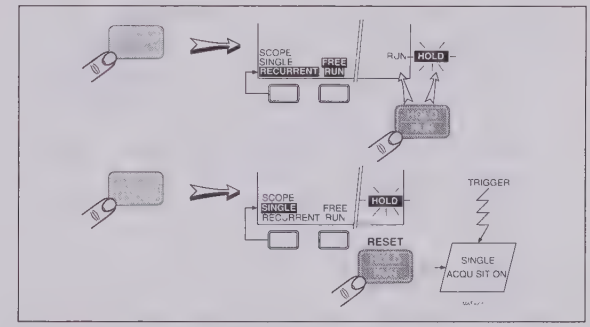
SINGLE acquisition

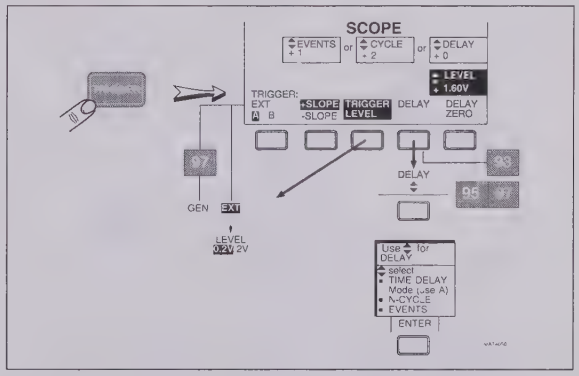
1. Press the **SCOPE** key.
2. Select the **SINGLE** acquisition mode.
   A flashing HOLD on the display indicates the end of the acquisition.
3. Press the **FREE RUN** soft-key to turn off the free run mode.
4. Press the HOLD/**RUN** key to rearm the trigger circuit.

NOTE "NOTRIG" indicates the ScopeMeter is armed and waiting for a signal to trigger on. In the free run mode the ScopeMeter resets, and restarts an acquisition of its own after 100 ms, if no trigger has been detected.

TRIGGER SOURCE

1. Press the **TRIGGER** key.
2. Press one of the blue softkeys to:
   - Select the trigger source via channel **A**, channel **B**, or the **EXT**ernal trigger input/**GEN**erator output. The Generator must be off to use the **EXT**ernal trigger input (Model 97).
   - Select the trigger **+SLOPE** or **-SLOPE**.
   - Select the **TRIGGER LEVEL**.
     Press the ▲ ▼ Up Down keys to set the trigger

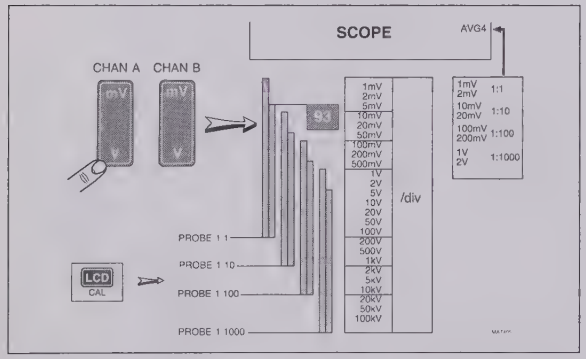




level needed when channel A or channel B is selected as trigger source. The external trigger input has a 2V TTL compatible trigger level, using a 1:1 probe.
Press the **LEVEL** 0.2V 2V softkey to set the 0.2V level, using 10:1 probe.

- Select the trigger time **DELAY** (Model 93)
  Press the [△] [▽] Up Down keys to set the trigger time delay needed.
- Select the trigger **DELAY** pop-up menu (Models 95 and 97) to enter the trigger function.
  Press the [△] [▽] Up Down keys to set the trigger function levels.
- Select the **DELAY ZERO** function to set the trigger delay back to zero.

ATTENUATOR

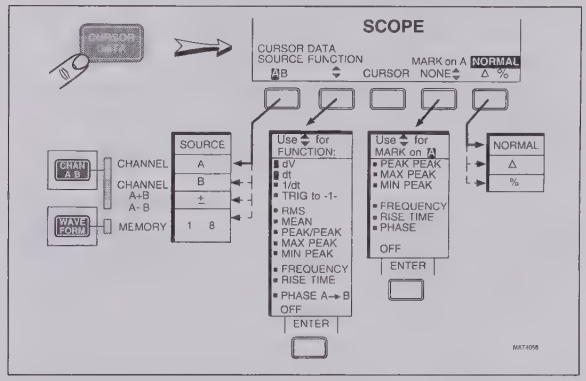


1. Press the **mV V** keys of channel A and B to step through the attenuator ranges.
2. Press the **LCD/CAL** key to calibrate and match the scope to another probe if needed.

NOTE For detailed probe calibration see Section 4 "INSTALLATION INSTRUCTIONS".

3.5 SCOPE MODELS 95 and 97

CURSOR DATA MODELS 95 and 97



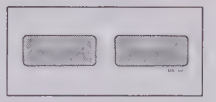
1. Press the **CURSOR DATA** key.
2. Press one of the blue softkeys to:
   - Select the cursor **SOURCE**.

     NOTE The cursor source is determined by one of the display traces. The traces can be obtained from the acquisition memory (A, B, A+B, A- B) or from the temporary or normal memory.

   - Select the cursor **FUNCTION** pop-up menu to select the cursor measurement, to display.
   - Select the **CURSOR** function.
   - Select the **MARK**er **on** channel **A** pop-up menu to select the marker functions.
   - Select a NORMAL, zeroed △ or scaled % result.

CURSOR POSITIONING MODELS 95 and 97

1. Press the **CURSOR 1** and **CURSOR 2** keys to position the cursors on the trace.



—|— is the left hand cursor 1.

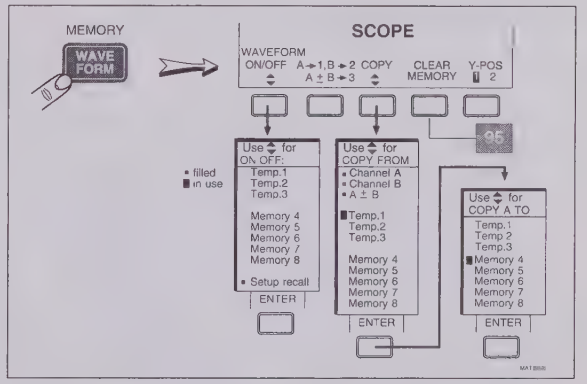
is the right hand cursor 2.

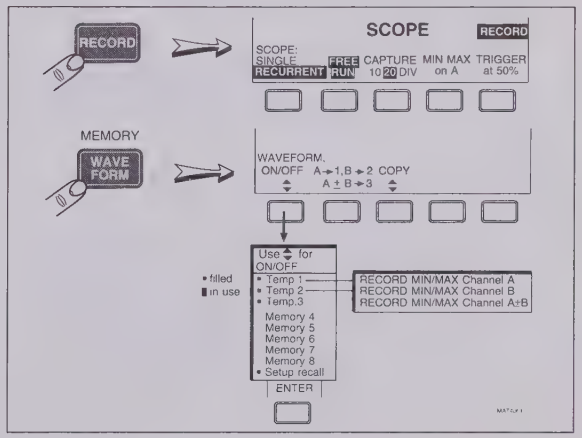
WAVEFORM MANIPULATION MODELS 95 and 97

1. Press the **WAVEFORM** key.
2. Press one of the blue softkeys to:
   - Select the **WAVEFORM ON/OFF** pop-up menu to select a trace to be displayed.
   - Enter the quick store function (from acquisition memory to temporary register A→1, B→2, A±B→3) where;
     A is stored in the **Tempo**rary **1** register.
     B is stored in the **Tempo**rary **2** register.
     A+B or **A-B** is stored in the **Tempo**rary **3** register.
   - Select the **COPY** waveform **FROM/TO** pop-up menu, to copy a trace into a memory.

SCOPE RECORDING MODELS 95 and 97

1. Press the **RECORD** key to record the channels.
2. Press the **WAVEFORM** key, and the WAVEFORM **ON/OFF** softkey to enter the pop-up menu for reading the envelope (minimum, maximum) of the selected channels A, B and A±B from the **Tempo**ry registers **1, 2** and **3**.



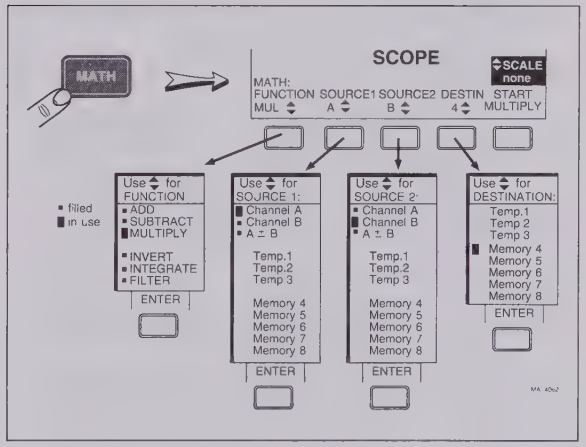


3.6 SCOPE MODEL 97

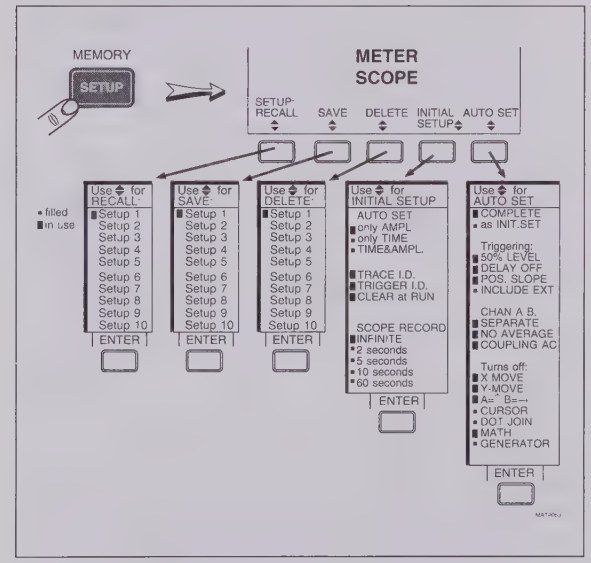
MATHEMATICS MODEL 97

1. Press the **MATH** key.
2. Press one of the blue softkeys to:
   - Select the mathematic **FUNCTION** pop-up menu to enter the mathematic operation.
   - Select the **SOURCE1** pop-up menu to enter the first operand.
   - Select the **SOURCE2** pop-up menu to enter the second operand. The operations **INVERT**, **INTEGRATE**, and **FILTER** need only source 1 as the operand in the waveform memory.
   - Select the **DESTINATION** pop-up menu to store the operation result.
   - To start the selected mathematic operation.
3. Press the UP Down keys [△] or [▽] to set the **SCALE** factor of the mathematic operation.

NOTE
Press the WAVEFORM key and the ON/OFF softkey to recall the operation result.



SETUP MEMORIES MODEL 97

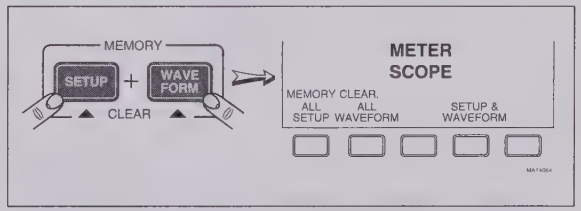


1. Press the **SETUP** key.
2. Press one of the blue softkeys to:
   - Select the **RECALL** setup pop-up menu to recall a saved setup from a setup memory (1 to 10).
   - Select the **SAVE** setup pop-up menu to save a setup into a setup memory (1 to 10).
   - Select the **DELETE** setup pop-up menu to delete a saved setup from a setup memory (1 to 10).

   NOTE
   The recall and delete softkeys remain black until a setup has been saved.

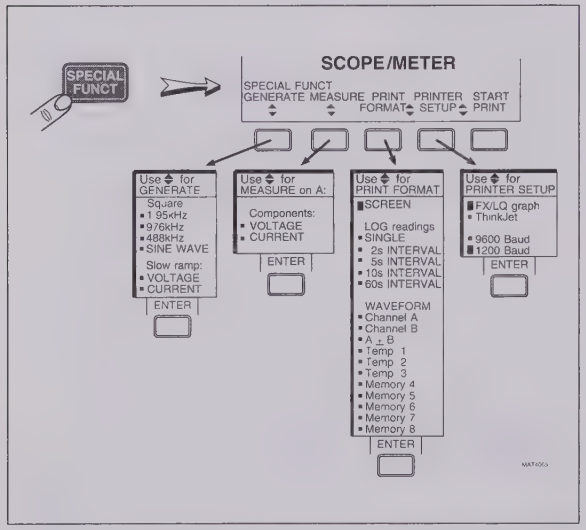
   - Select the **INITIAL SETUP** pop-up menu to enter new initial setup items.
   - Select the **AUTOSET** pop-up menu to enter the items on which the AUTOSET function will be performed.

CLEAR MEMORY MODEL 97



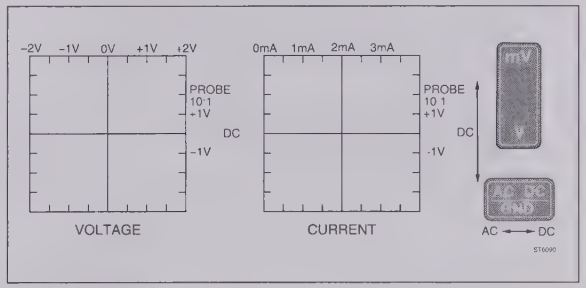
1. Press the **SETUP** and the **WAVEFORM** key simultanously.
2. Press one of the blue softkeys to:
   - Clear **ALL SETUP** registers.
   - Clear **ALL WAVEFORM** registers.
   - Clear all **SETUP & WAVEFORM** registers.

SPECIAL FUNCTIONS MODEL 97



1. Press the **SPECIAL FUNCT**ions key.
2. Press one of the blue softkeys to:
   - Select the **GENERATE** pop-up menu to enter test signals for electronic circuits.
   - Select the **MEASURE** on channel **A** pop-up menu to enter the optimum scope settings for measuring **COMPONENTS**.

NOTE
The generator output banana jacks generate a slow voltage or current ramp. The characteristics of the component tested are shown on the display. Connect the component to the generator output banana jacks. Measure the component via the red BNC channel A.



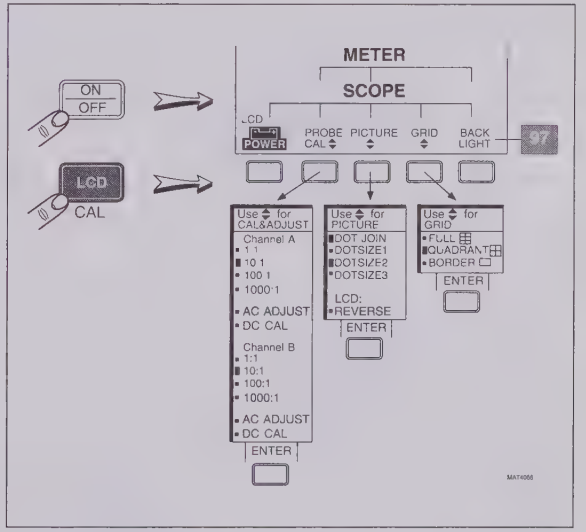
- Select the **PRINT FORMAT** pop-up menu to enter the print sources.
- Select the **PRINTER SETUP** pop-up menu to enter printer settings.
- Select the **START PRINT** mode.

NOTE
Press the HOLD key before pressing START PRINT, except in the cursordata logging function, to avoid printout errors.

3.7 USEFUL TIPS

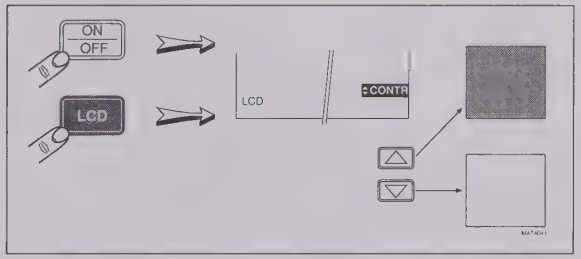
LCD and CAL (Calibration)

1. Press the **LCD** key. The LCD key is automatically selected when the ScopeMeter is first turned on.
2. Press one of the blue softkeys to:
   - Select the **PROBE CAL**ibration pop-up menu. See Section 4 "**INSTALLATION INSTRUCTIONS**" for probe adjustment and calibration.
   - Select the **PICTURE** pop-up menu to adjust the display.
   - Select the scope **GRID** pop-up menu to choose a desired scope grid.
   - To turn on/off the **BACKLIGHT** (Model 97).

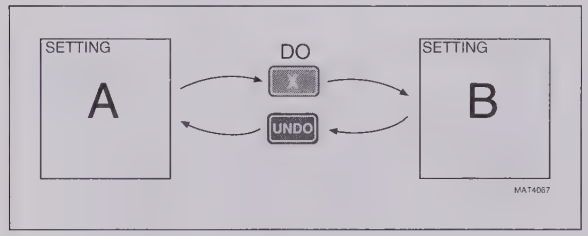


CONTRAST adjustment

1. Press the **LCD** key.
2. Press the ⏶ ⏷ Up Down keys to adjust the contrast of the display.

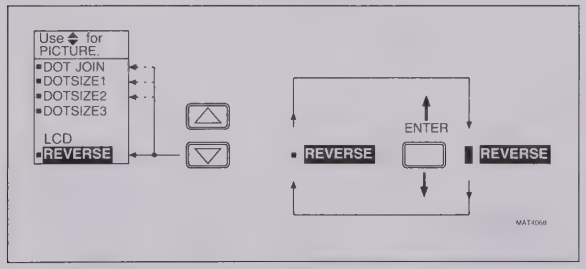


UNDO (Deletion of setups) MODEL 97



1. Press **UNDO** to delete a setup.
   Undo allows you to step back 10 setups.

POP-UP MENU POINTER operation

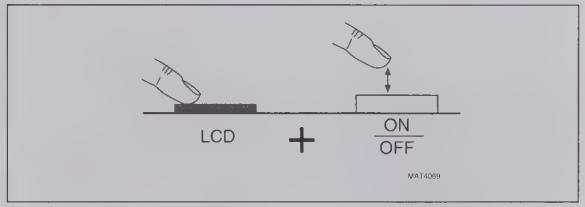


1. Press the [△] [▽] Up Down to select an item to enter.
   A selected item is indicated in reverse video.
2. **ENTER** the selected item.
   An active function is preceded by a large dot.
   A non active function is preceded by a small dot.
   The pop-menu dissappears after pressing the ENTER softkey, or after 10 seconds.

Example:
- DOTSIZE 1
- DOTSIZE 2 ← ACTIVE (ON)
- DOTSIZE 3

NOTE
If more than one item can be active, the pop-menu disappears after pressing the pop-menu softkey again (reverse video), or after 10 seconds.

MASTER RESET



1. Press the **ON/OFF** key to turn off the ScopeMeter.
2. Hold down the **LCD** key and press the **ON**/OFF key.
   Wait for the double beep before releasing the LCD key.

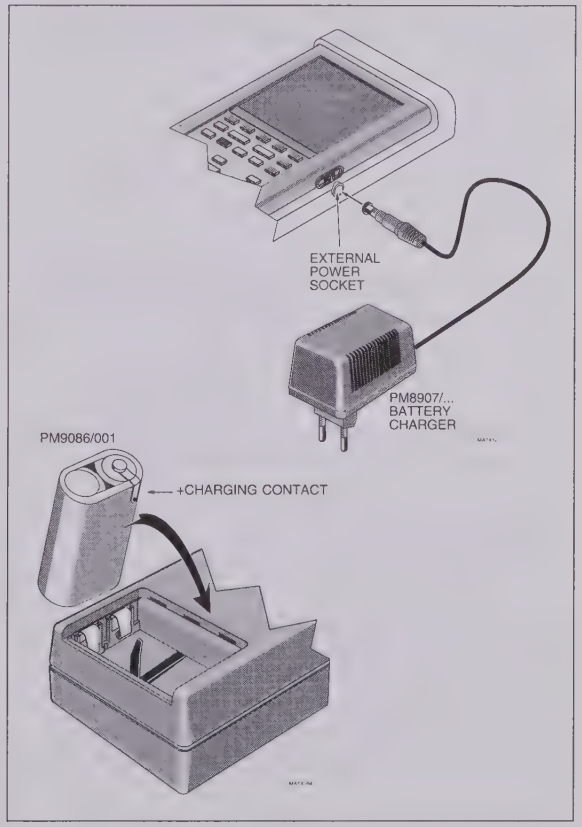
4.1 POWER SUPPLY

WARNING
When the instument is connected to its power adapter/battery charger, terminals may be live, and the opening of covers or removal of parts (except those to which access can be gained by hand) is likely to expose live parts.
The instrument must be disconnected from all voltage sources before it is opened for any adjustment, replacement, maintenance, or repair.
Capacitors inside the instrument may still be charged even if the instrument has been disconnected from all voltage sources.

GENERAL

Included in the delivery of the ScopeMeter is a rechargeable NiCad battery pack PM9086/001. This pack is already placed in the battery compartment of the ScopeMeter. The ScopeMeter is powered via rechargeable batteries, which are recharched by PowerAdapter/Battery Charger PM8907 delivered with the instrument.

NOTE
When new, the NiCad Battery Pack is not fully charged. It is necessary to charge the batteries for a minimum of 16 hours. The operation time of the ScopeMeter with fully charged batteries is typically 4 hours.



Before charging the NiCad Battery Pack with Battery Charger PM8907, make sure that the charger corresponds with your local line voltage.

Overview of Battery Chargers
PM8907/001 Universal Europe. 220V, 50 Hz.
PM8907/003 North America. UL, CSA, 110V, 60 Hz.
PM8907/004 United Kingdom. 240V, 50 Hz.
PM8907/008 Universal. 115/230V.

HOW TO CHARGE THE BATTERY PACK AND POWER THE SCOPEMETER

⚠ USE ONLY PM8907 AS A POWER ADAPTER

1. Insert the Power Adapter/Battery Charger PM8907 low voltage plug into the POWER ADAPTER connector of the ScopeMeter.
2. Connect the Power Adapter/Battery Charger PM8907 to the line voltage.
   - Turn off the ScopeMeter to charge the NiCad Battery Pack.
   - Turn on the ScopeMeter to charge the NiCad Battery Pack and power the ScopeMeter.

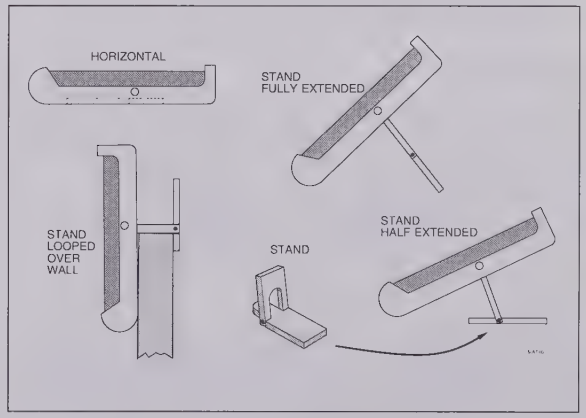
   NOTE
   At turn on battery power POWER *or* ADAPTER POWER *is displayed to indicate the power source.*

DURING OPERATION WHEN THE BATTERIES ARE LOW, A BLINKING − [− +] − SYMBOL APPEARS IN THE LOWER LEFT CORNER OF THE DISPLAY.

4.2 STAND AND HOLSTER

The ScopeMeter comes with a form fitting holster that absorbs shocks and protects the ScopeMeter from rough handling.

The Scopemeter is also equipped with a Multi-Position Stand. Some uses of the Holster and Stand are shown.



4.3 PROBE ADJUSTMENTS AND CALIBRATION

IMPORTANT

TO MEET THE FULL USERS SPECIFICATIONS FOR THE SCOPEMETER, IT IS ESSENTIAL THAT YOU USE ONLY SCOPE-PROBES THAT ARE CALIBRATED ON THE SPECIFIC INPUTS OF THE INSTRUMENT.

WARNING
TO AVOID ELECTRICAL SHOCK OR FIRE: USE ONLY PROBES DESIGNED FOR THIS INSTRUMENT FOR MEASUREMENTS WITH COMMON >42V pk ABOVE EARTH OR ON CIRCUITS >4800 VA.
USE PROBES WITHIN RATINGS AND INSPECT BEFORE USE.
REMOVE TEST LEADS NOT IN USE.
REMOVE LEADS BEFORE OPENING CASE OR BATTERY COVER.

The ScopeMeter comes with a set of probes that are already adjusted and calibrated on the specific ScopeMeter channels at delivery.
Use the RED probe on the RED channel A, and use the GREY probe on the GREY channel B.
Periodic dc calibration and ac adjustment assures accurate measurements.

PROBE DC CALIBRATION AND AC ADJUSTMENT PROCEDURES

- The following procedures describe dc calibration and ac adjustment for channel A and the RED scope probe, and for channel B and the GREY scope probe.

PRESETTINGS

1. Turn **ON** the ScopeMeter.
2. Connect the **RED SCOPE PROBE** to the channel **A (RED) BNC** input.
3. Connect the RED **ADJUST ADAPTER** to the RED banana jack **GENERATOR OUT**put.
4. Connect the **RED SCOPE PROBE** to the RED **ADJUST ADAPTER**.
5. Press the **LCD/CAL** key.
6. Press the **PROBE CAL** soft key to select the CALibration & ADJUST pop-up menu.

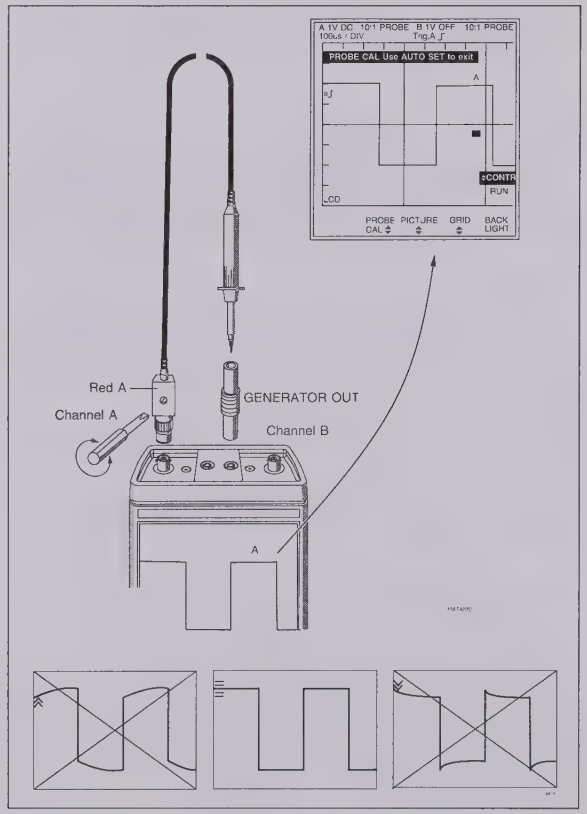
DC CALIBRATION

1. Perform the steps given above under PRESETTINGS.
2. Press the △ ▽ Up Down keys to select the DC CAL of Channel A.
3. Press the **ENTER** soft key to enter the DC CALibration mode.
   - The gain of the probe will be automatically calibrated. The ScopeMeter outputs a voltage on the GENERATOR OUTput banana jack to the connected probe.

- If a 1:1 or 1:10 probe has been connected, the ScopeMeter automatically sets itself to the correct probe and calibrates itself.
  If a 100:1 or 1000:1 probe has been selected.
  DC calibration is prohibited.
  The ScopeMeter itself will end the DC CALibration with the message "PROBE succesfully calibrated" and return back to its previous setup.

AC ADJUSTMENT

1. Perform the steps given above under PRESETTINGS.
2. Press the [△] [▽] Up Down keys to select and enter the correct probe (1:1, 10:1, 100:1 or 1000:1) and to select the AC ADJUST mode of Channel A.
3. Press the **ENTER** soft key to enter the AC ADJUST mode.
   - The HF part of the probe can now be adjusted. The ScopeMeter outputs a square wave on the GENERATOR OUTput banana jack to the connected probe. The ScopeMeter also sets itself automatically to the correct attenuation and timebase.
4. Adjust the trimmer in the probe housing of channel A to give an optimum square wave within the markers on the display.
5. Press the **AUTOSET** key to turn off the AC ADJUST mode.



5.1 SCOPEMETER

GENERAL

This section explains the separate functions of the ScopeMeter. Refer to the Quick Operating Guide for explanation of the relationship between the function and their pop-up menu. The Quick Operating Guide is placed in the Holster, which is provided with the ScopeMeter.

POWER ON/OFF

At power-on, the ScopeMeter starts with the settings that were active at power-off. The soft-keys are set to the LCD menu using the △ ▽ Up Down keys the contrast of the display can be adjusted for the best viewing (See Section 2 GETTING STARTED QUICKLY).

5.2 METER

METER AUTO-MEASUREMENT FUNCTION

The METER mode has an initial auto-measurement function. This function accurately measures the signal supplied to channel A without making any additional meter settings.

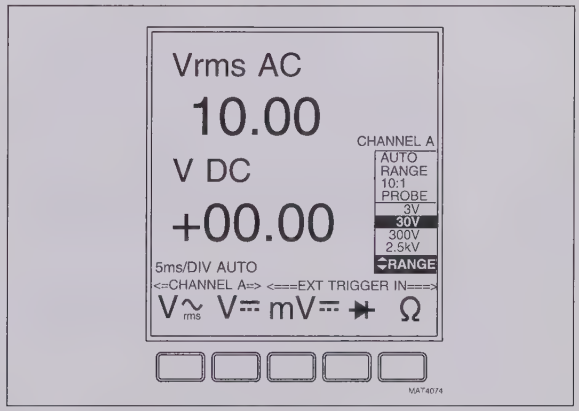
The auto-measurement function is turned on when:
- Switching from the SCOPE to the METER mode.
- Pressing the **AUTOSET** key in the METER softkey menu.

The initial METER auto-measurement settings are:

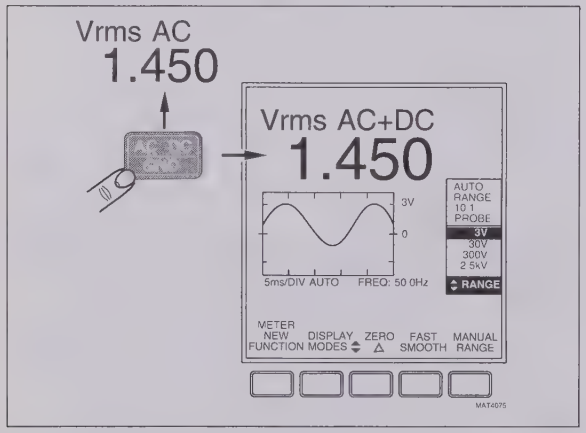
Function: Volt-rmsAC and Volt-DC.
Both the ac and dc part of the input signal supplied to channel A are separately displayed.

Ranging: Automatic of timebase and attenuator, using a 10:1 scope probe.

Input: Channel A, BNC (Red)



METER FUNCTIONS AND METER RANGES



Once a meter function is selected, the softkey menu jumps to the corresponding specific function control menu. The measuring result is displayed as a $3\,^{2}/_{3}$-digit display and a corresponding scope trace. In manual ranging mode, the ranges are selected with the △ ▽ Up Down keys or with the CHANNEL A **mV V** key. An overview of the ranges and the highlighted selected range is shown on the display. The ScopeMeter comes with a set of 10:1 probes that are adjusted and calibrated on the ScopeMeter.
For selecting another probe, see "PROBE ADJUSTMENTS AND CALIBRATION" in section 4.

V~ rms Alternating Voltage Root-Mean-Square function, Vrms AC Signals supplied to channel A will be measured. The measurement result is displayed as a $3\,^{2}/_{3}$-digit numeric display and a scope trace. A selection between ac and dc coupled input can be made. For the 10:1 scope probe, the actual ranges are 3V, 30V, 300V and 2.5 kV.

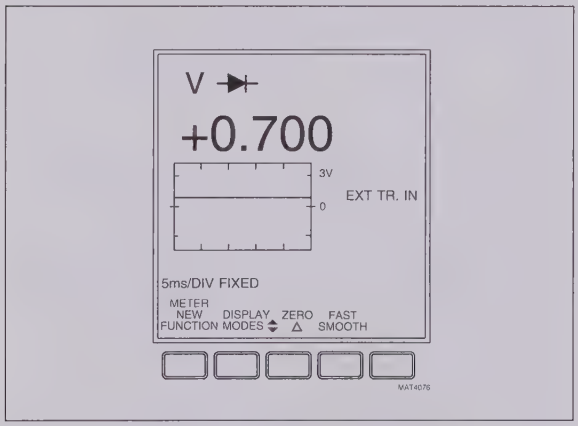
V⎓ Direct Voltage function, V DC. Signals supplied to channel A will be measured. The measurement result is displayed in a $3\,^{2}/_{3}$-digit display and a scope trace. For the 10:1 scope probe the actual ranges are 3V, 30V, 300V and 3 kV.

mV⎓ Direct milliVolt function, mV DC. Signals supplied to the mVΩ⊣⊢ and ⏚ COMmon banana jack inputs are measured. The measurement result is displayed as a $3\,^{2}/_{3}$-digit display and a scope trace. The ranges are 300 mV and 3V.

⊣⊢ Diode test function. Using the function, a diode connected to the mVΩ⊣⊢ and ⏚ COMmon banana jack inputs can be tested. The measurement current through the diode is 0.5 mA. The RED banana jack is the high input while the BLACK one is the low.

NOTE
In the diode and resistance test function the black COMmon banana jack is not connected internally to the common of the scope BNC inputs of channel A and B.

The result is displayed as the forward or reverse voltage of a diode.



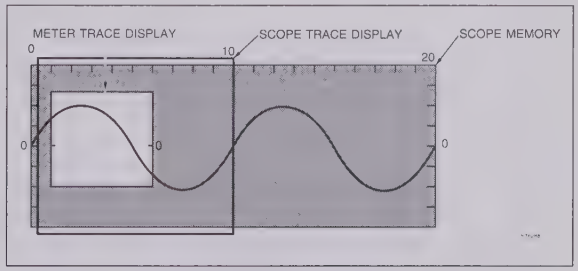
Ω Resistance function. A resistor connected to the mVΩ and COMmon banana jack inputs will be measured. The RED banana socket is the high input while the BLACK one is the low.

NOTE
In the diode and resistance test function the black COMmon banana jack is not connected internally to the common of the scope BNC inputs of channel A and B.

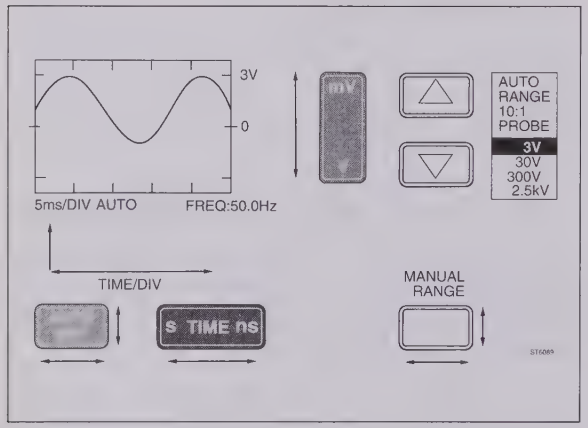
The measurement result is displayed as a 3 $^{2}/_{3}$-digit display. The ranges are 300Ω, 3 kΩ, 30 kΩ, 300 kΩ, 3 MΩ and 30 MΩ. A beeper warning is generated at <5% of a selected range in manual range mode. A beeper warning is turned on with ALERT))) in the DISPLAY MODES pop-up menu.

SCOPE TRACE DISPLAY IN THE METER MODE

The ScopeMeter automatically shows a "5 division scope trace" after the first detected trigger. An optimum scope trace display of at least ≥2 periods in 20 divisions assures an optimum meter display result.



In the functions Vrms AC (+DC), and VDC the timebase of the scope trace, and the attenuator range of both the scope trace and meter display result can be selected.



The timebase is expressed as time/division. If the trace is not displayed, the expression time/division is used to give an indication for the timebase of the system.

TIME/DIVISIONS (AUTO or MANUAL)

		100,	50,	20,	10,	5,	2,	1,	ms
500,	200,	100,	50,	20,	10,	5,	2,	1,	µs

only MANUAL

NOTE
1 acquisition is 20 divisions.
5 divisions are automatically displayed.

METER-FUNCTION CONTROL SOFT-KEY MENU

Once you have selected a specific meter function, the ScopeMeter displays to the menu listed below.

NEW FUNCTION Returns to the METER function menu.

DISPLAY MODES ◆ In the display modes pop-up menu the display and measurement result can be selected. At the moment the pop-up menu is turned on the display is frozen, but the acquisition continues.
The measurement result has been captured for further adjustment. While the result is captured, the ScopeMeter keeps on measuring to trace the measured input signal continuously. The actual measurement result is displayed when you leave the display modes function again.

ALERT))) The alert function warns the user when the measurement result changes more than 100 digits. In function resistance (Ω) the alert function also warns at <5% of the measuring range.

FREQUENCY When frequency is selected, the meter voltage result display is replaced by the meter frequency result display. Measures the frequency of the input signal in function Vrms AC function, Vrms AC + DC, and V DC function.

TRACE DISP Trace display turns the scope trace off and on. In functions V∿ rms, V⎓ additionally the frequency value will be displayed if the trace is turned off.

% △ **(Models 95 and 97)** Percentage change (delta) (Relative reference) zeroes the present reading. It displays any result using the formula described under the **ZERO** △ function. If trace is turned off, the mathematic results of the measurement result are displayed as an additional result display. If trace is turned on, the measurement result is replaced by the mathematic result.

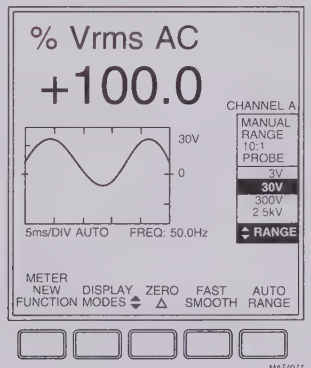
SCALING (Models 95 and 97) Scaling displays the present measurement result with respect to a defined range with a 0% and 100% value. The 0% and the 100% value must be entered before the scaling function is turned on. The new displayed value is calculated using the following formula:

$$\%\ \text{reading} = \frac{(\ \text{new reading} - 0\%\ \text{value}\ )}{(\ 100\%\ \text{value} - 0\%\ \text{value}\ )} * 100$$

HOW TO ENTER THE 0% AND 100% SCALING VALUES
- Measure the value you want to be the 0% value.
- Select the DISPLAY MODES function.
- Select with the △ ▽ Up Down keys the 0% item in the pop-up menu.
- Press ENTER to store the 0% value.

NOTE
Enter the 100% value in the same way as the 0% value.

Example:
Function V∿rms
0% =short circuited
100%=measurement value



HOW TO TURN ON THE SCALING FUNCTION
The scaling function is automatically turned on if both the 0% and 100% value have been entered.

HOW TO TURN OFF THE SCALING FUNCTION
- Select another Meter function or,
- Select and ENTER the Scaling ON item in the DISPLAY MODES pop-up menu.

RESULT IN (Models 95 and 97) The result in dBV (decibel Volts), dBm (decibel milliwatt). dBW (decibel Watt) and Audio Watt function converts the measured signal into the selected units. For the dBm, dBW and Audio Watts functions a range of reference impedances can be selected using the △ ▽ Up Down keys after the function has been entered.
For the dBm function, the following reference impedances can be selected: 50, 60, 75, 93, 110, 125, 135, 150, 250, 300, 500, 600, 800, 900, 1000 and 1200Ω.
For the dBW and Audio Watts functions the following reference impedances can be selected: 1, 2, 4, 8, 16 and 50Ω.

ZERO △ The zero function will take the present measuring result as a relative reference value. All new readings will be calculated using the reference value as the new zero. The zero function can also be used with dBV, dBm, dBW or Audio Watts.
In the display modes function any % Δ new reading is calculated with:

$$\%\,\Delta\ \text{reading} = \text{result} - \text{zero}$$

$$\%\,\Delta\ \text{reading} = \left(\frac{\text{new reading} - \text{zero value}}{\text{zero value}}\right) * 100\%$$

FAST SMOOTH Fast accelerates the refresh rate in the measurement result display. A fast refresh rate facilitates adjustment readings. Smooth averages the last 6 seconds of readings. It reduces the influence of noise or unstable input signals.

MANUAL / AUTO RANGE Sets the selected function to manual or automatic ranging mode of the timebase and attenuator if possible. In DIODE TEST, manual ranging is not possible. The attenuator range area in the display shows the ranges possible and the selected ranging mode. Use the △ ▽ Up Down keys to select the attenuator ranges. The ScopeMeter automatically switches to the manual ranging mode if the △ ▽ Up Down keys are pressed.
Use the s TIME ns key to selct the timebase ranges. The ScopeMeter automatically switches to the manual ranging mode if the timebase key is pressed.

METER TOUCH HOLD® FUNCTION

The Touch Hold function captures the next stable measurement result. A beep indicates that a stable result has been captured. When first enabled, the numeric display is frozen (held) until a stable result is detected. Stable results are defined as within +/-100 display counts for 1s; and above a floor of 200 display counts in VDC and mVDC, 300 display counts in VAC, and below overload (OL) in Ω and diode test.

® Touch Hold is a registered trade mark of the John Fluke Mfg. Co., Inc.

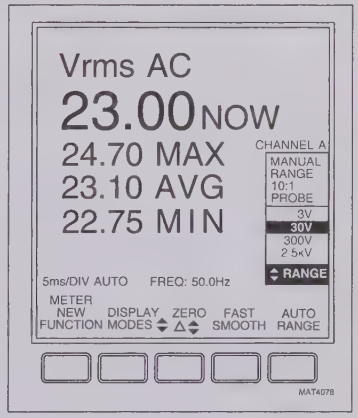
NOTE
The combined initial Vrms AC/V DC function, the FREQUENCY function, the SMOOTH and FAST function, and the RECORD function (model 95 and 97) are excluded from Touch Hold.

METER DISPLAY HOLD (Models 95 and 97)

In function Vrms AC/V DC, RECORD and FREQUENCY, hold freezes the display.

METER RECORD (Models 95 and 97)

In the record mode the ScopeMeter records the MINIMUM, MAXIMUM, and AVERAGE readings within a selected meter function range. Leaving the function turns off the record mode. The MIN, MAX and AVG readings are displayed together with the actual measurement result. New measured MIN, MAX, and AVG readings will be refreshed on the display.



The ScopeMeter Models 95 and 97 DISPLAY MODES and ZERO △ soft keys have an extended pop-up menu in comparison to ScopeMeter Model 93.
The extensions are valid in the Scaling and the Zero functions. For explanation of the scaling and the zero functions, see "METER FUNCTION CONTROL SOFT-KEY MENU" earlier in this section.

SCALING EXTENSIONS MAX, MIN and AVG values are entered in the same way as 0% and 100% values.

ZERO EXTENSIONS MIN, MAX and AVG values are entered in the same way as relative reference values.

5.3 SCOPE

The SCOPE key selects the SCOPE acquisition modes menu.

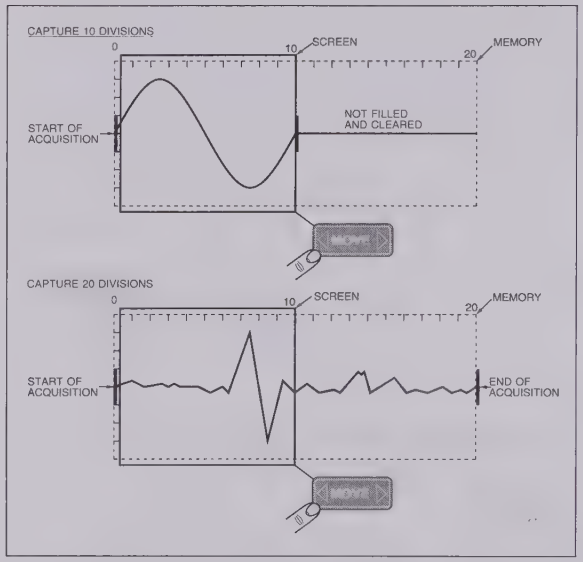
SCOPE ACQUISITION MODES

SINGLE In the single acquisition mode, the timebase range is 5s/div. to 100 ns/div. Use the **s TIME ns** key to change the timebase settings. A flashing ~HOLD~ on the display indicates the end of the acquisition.
Press the **HOLD** key to start a new single acquisition.

RECURRENT In the recurrent mode, the timebase range is 5s/div. to 10 ns/div. Use the **s TIME ns** key to change the timebase settings.

The ROLL mode is automatically turned on if a timebase slower than 5s/div. is selected. The timebase range is 60s/div. to 10s/div. For the first time the screen is filled from left to right. Use the **s TIME ns** key to change the timebase settings. The ROLL mode is automatically turned off if a timebase faster than 10s/div. is selected. As the ROLL mode is a self triggered mode, the CAPTURE 10 20 DIV function, TRIGGER at 50% function, and FREE RUN function cannot be operated.

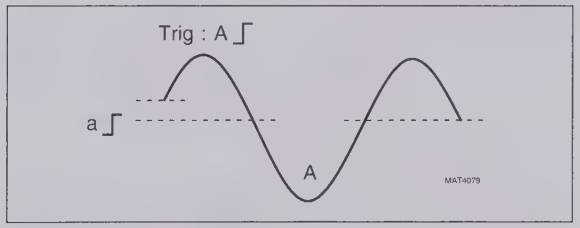
CAPTURE 10 **20** DIV Sets the ScopeMeter to capture acquisitions in 10 or 20 divisions.
Use capture 10 divisions (one screen) for low frequency signals. Use capture 20 divisions (two screens) for high frequency signals and single sweep (one shot) signals.



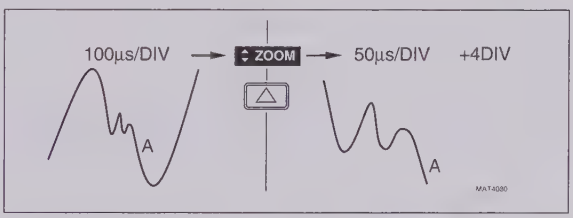
FREE RUN The ScopeMeter generates a trigger of its own if it has detected no trigger within 100 ms after the (re)start of an acquisition. Free-run generates a "living" display.

MIN MAX on A (Models 95 and 97) The MINimum MAXimum mode stores and displays the events that occur in between two samples on channel A. Channel B is turned off. The events can be glitches or other asynchronous signals, wider than 40 ns.
The glitches between the samples can still be stored and displayed using the MIN MAX mode on A. The result is displayed as overruns (new MAXimums or MINimums) of the previous displayed signal.

TRIGGER at 50% Sets the trigger level at 50% of the input signal voltage, using the active input trigger source as reference. For example if channel A and +SLOPE have been selected, the ScopeMeter automatically triggers at 50% of the input signal voltage



ZOOM (Models 95 and 97) Zooms in on or cuts out the signal part around the fourth division on the display. The ScopeMeter zooms in by increasing the timebase one step. Also the trigger delay is recalculated. Use the Up Down keys to ZOOM in and out.



CHANNEL CONFIGURATION

The channel configuration menu selects the scope channels and basic mathematics functions. Selections are turned on/off by pressing the corresponding softkeys.

CHANNEL ON/OFF

A At least one trace must be turned on (A or B or a memory).

B INVERT Channel A and B are continuously stored in the acquisition memories for usage in the mathematical functions (A+B, A-B).
Maximum number of channels:
A limit of four traces can be displayed simultaneously. This is possible by displaying a mix of channnels and waveforms, for example: channel A and B, and A+B, and recalled waveforms from memory (Models 95 and 97 only). The A versus B (A= ↑ , B= →) is not included in the limit.

MATHEMATICS

A+B
A-B
The mathematical function executes mathematical operations on channels A and B. It is possible in the A+B and A-B function to turn off channels A and B.

CHANNEL A VERSUS B

A= ↑
B=→
The A versus B function sets channel A (Y) against channel B (X).

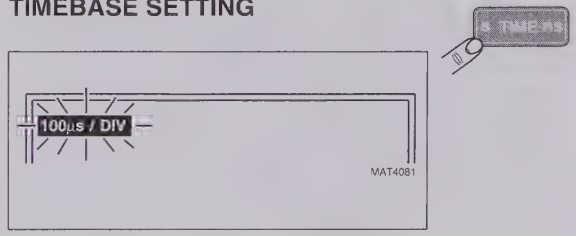
AVERAGE (Models 95 and 97)

AVG To suppress noise without loss of bandwidth, the ScopeMeter can average with the factor shown on the display. The factor can be selected with the △ ▽ Up Down keys (Factors available are: OFF, 2 4 8 sequence and maximum 256) The average function is turned off with the AVERAGE OFF softkey.
Average and MIN/MAX exclude each other.

$$\text{New} = \text{previous} + \frac{\text{measured - previous}}{\text{factor on display}}$$

In the attenuator ranges 10 mV and 20 mV, using a 10:1 scope probe, the average factor is automatically set to 4. Select the 50 mV attenuator range to turn off the average factor. In the ROLL mode the average factor is automatically set to 10 with the △ Up key. In the adjust menu on the display the ROLL mode average factor 10 is shown as AVERAGE ON.

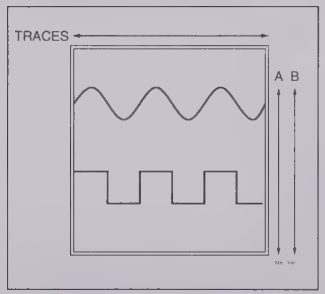
TIMEBASE SETTING

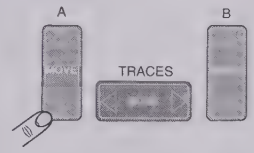


The s TIME ns key selects the timebase.
The range of the timebase in steps of 1, 2, 5 is:

Recurrent	10 ns/division 5s/division.
Single	100 ns/division 5s/division.
Roll	10s/division 60s/division.

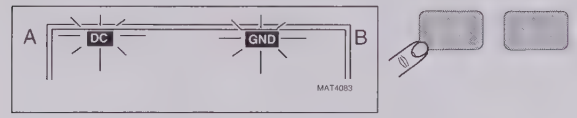
TRACE MOVEMENT





The MOVE keys move the traces to almost any area of the LCD. The traces can be directed in the Y direction separately. The range of the Y-position is +/- 4 divisions. In X direction the traces are moved simultaneously. The range of the X-position is from -4 to +16.5 divisions.

CHANNEL INPUT COUPLING (AC/DC/GND)



The AC/DC/GND keys select the input coupling of channel A and B.
The sequence is AC, DC, and GND.

AUTO SET FUNCTION OF THE SCOPEMETER

The AUTOSET function automatically selects the optimum settings for a connected input signal. The AUTOSET function is entered by pressing the AUTOSET key while in the scope mode. The function searches the inputs to find any triggerable signal and sets the ScopeMeter to the optimum settings.
The main settings of the AUTOSET function are:
- Turn on channel A and/or channel B; turn off everything else.
- The signal with the lowest frequency (<5 MHz) is displayed 2 to 8 periods.
- The attenuation is set so that the signal is about four divisions.
- The trigger source is selected to the channel that has the lowest frequency.

Model 97: AUTO can be configured via the SETUP key and the AUTO SET pop-up menu.

HOLD/RUN AND SINGLE ACQUISITION

In the RECURRENT acquisition mode HOLD/RUN stops and starts an acquisition. A flashing HOLD on the display indicates the hold mode.
In SINGLE acquisition mode HOLD/RUN starts the single acquisition. A flashing HOLD on the display indicates the end of the acquisition. FREE RUN must be off to wait for a single acquisition.

TRIGGER SOURCE

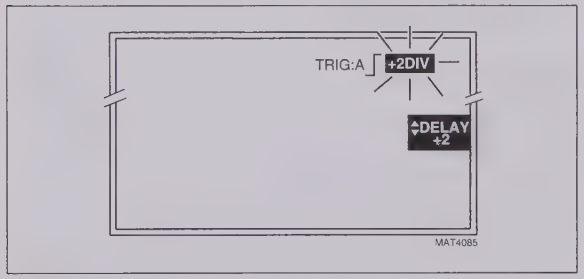
EXT A B Trigger source selection. A and B via the channel inputs, EXTernal via the banana EXT trigger input. Waveform GENERATE must be off (Model 97) to select EXT.

+SLOPE - SLOPE Trigger slope selection.

TRIGGER LEVEL Trigger level selection. Press the TRIGGER LEVEL soft key to set the adjustable trigger level mode.

Use the [△] [▽] Up Down keys to adjust the trigger level from +4 divisions to -4 divisions, when channel A or channel B is selected as trigger source. Press the LEVEL **0.2V**, **2V** softkey to set the trigger level, when the external trigger input is selected as the trigger source.

[DELAY] (Model 93) Use the [△] [▽] Up Down keys to set the trigger time delay. The delay range is from +1023 to -20 divisions. The initial time delay is 0 (zero).



[DELAY ◆] (Models 95 and/or 97) Different trigger delay modes are located in the DELAY pop-up menu. It is possible to select more then one modes simultaneously (TIME DELAY, N-CYCLE or TIME DELAY+EVENTS). In the top part of the pop-up menu the [△] [▽] Up Down keys are assigned to the modes for adjustments.

The bottom part of the pop-up menu selects the N-CYCLE or the EVENTS mode.

TIME DELAY	TRIG:A ⌐ +2DIV
CYCLE	TRIG:A ⌐ +2CYC
EVENTS	TRIG:A ⌐ +1EVT
DELAY+CYCLE	TRIG:A ⌐ +2CYC+2DIV
DELAY+EVENTS	TRIG:A ⌐ +1EVT+2DIV

MAT4086

TIME DELAY See DELAY for all models.

N-CYCLE In the N-cycle mode the trigger signal is divided by N to create a stable picture for signal with a cyclic character. Use N-cycle to measure the ignition pulse on a bobine of a N-cylinder engine. The N-cycle mode is possible for channel A only. The number of N-cycles can be selected with the [△] [▽] Up Down keys. The initial N-cycle number is 2.

EVENTS In the EVENTS mode the triggering via the external trigger input can be delayed for a number of events. The event is the trigger condition for channel A. The number of events can be selected with the [△] [▽] Up Down keys.

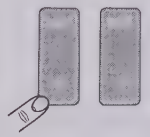
DELAY ZERO Resets all the selected trigger delays to their initial values.

TIME DELAY	to +0 divisions.
N-CYCLE	to 2.
EVENTS	to 1.

⇳DELAY time, ⇳CYCLE number, ⇳EVENT number.

Use the [△] [▽] Up Down keys to adjust the level or numbers. Use the DELAY ZERO softkey to reset the time and delay numbers to the initial values.

ATTENUATOR



The total attenuation is from 10 mV per division to 1 kV per division in a 1-2-5 range sequence, using the10:1 probe. Dependent on what probe the ScopeMeter is calibrated to, a block of ranges is available. In the 10 mV and 20 mV ranges (Models 95 and 97), using the 10:1 probe, the AVERAGE function is turned on. The average factor used is 4 and is shown on the display attenuator.
The AVERAGE function and the MIN/MAX function exclude each other.
To turn off select another attenuator range.

5.4 SCOPE MODELS 95 and 97

CURSOR DATA (Models 95 and 97)

In the CURSOR DATA mode, the cursor source functions, cursors, or markers and the output result can be selected.

[SOURCE A B±] Allows you to select the trace on which the cursor measurements should be made. The channels can be A, B, A+B, A-B, or the waveforms that have been stored in memory 1 to 8. If only one trace is displayed, there is no source indication.

[⇳ FUNCTION] In the FUNCTION pop-up menu a selection of the measuring functions can be made. The measurement results are displayed on the righthand side. A maximum of five measuring functions can be turned on at the same time.

dV	: voltage difference between (vertical) cursors.
dt	: time difference between (horizontal) cursors.
1/dt	: reciprocal value of dt.
trig to -1-	: time difference between trigger and cursor 1.
RMS	: RMS value of signal between cursors.
MEAN	: MEAN value of signal between cursors.
PEAK/PEAK	: PEAK to PEAK value of signal between cursors.

MAX PEAK : Peak to ground value of signal between cursors.
MIN PEAK : Negative peak to ground value of signal between cursors.
FREQUENCY : Frequency of signal between cursors.
RISE TIME : Rise time of signal between 10% and 90% of signal 0% and 100% levels determined by intersection of signal and cursors.
PHASE : Phase shift between two traces. A maximum of 3 phase shifts is possible.

[CURSOR] Cursor measurements on/off.

[MARK on A NONE ⬍] The marker functions are selected in the MARK on trace X (A, B, ±, 1 to 8) pop-up menu. The selected function will be displayed under the MARK on X indication in the softkey menu (**PEAK/PEAK, MAX PEAK, MIN PEAK, FREQUENCY, RISETIME, PHASE, or OFF**). Once a function is selected, the markers will be set to the most optimum positions where or between where the result that is expected. The markers show on what area of the input signal a result is measured.

[NORMAL △ %] Normal, △ relative reference or scaled % measurements can be made with the selected cursor functions.

CURSOR POSITION) (Models 95 and 97

The cursor keys allow positioning of the lefthand and righthand cursor.

WAVEFORM (Models 95 and 97)

The waveform function saves, copies, and recalls waveforms into memories. Three acquisition memories, three temporary registers, and five memories are used. The temporary registers are used to save the contents of the acquisition memories A, B and A ± B (Mathematics), if active, in one action.

[ON/OFF ⬍] In the ON/OFF pop-up menu, the saved waveforms and the corresponding setup can be recalled. A small dot in front of the item indicates that the item is filled with a waveform. A large dot in front of an item indicates that the waveform is displayed. A displayed waveform has a figure indication that corresponds with the waveform memory number.
The maximum number of waveforms that can be displayed is four. The Y-position of the recalled waveforms can be changed with the [△] [▽] Up Down keys.
The X-position can be changed with the ◁MOVE▷ key.

A→1 ,B→2
A ± B →3
Copies the contents of the acquisition memories A, B and A ± B (Mathematics) to the waveform temporary registers 1,2 and 3. The copying is done in one action.

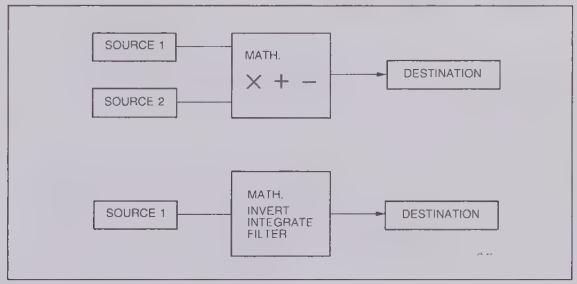
COPY ◆
In the COPY pop-up menu, the waveform source Channel A, B or A ± B, temporary memories 1,2, and 3, or memories 4 to 8 can be copied to destination memories 4 to 8.

SCOPE RECORD (Models 95 and 97)

In the SCOPE RECORD mode the envelopes (minimum and maximum) of the acquisition channels A and B, and the A ± B are recorded. The envelopes are saved in the temporary memories 1, 2, and 3.
The display shows the measured points together with the actual signal.
In the WAVEFORM function, the result can be seen.

5.5 SCOPE MODEL 97

MATHEMATICS (Model 97)



In the MATHematics mode two operands are used for adding, subtracting, and multiplying. The result is placed in a destination waveform memory. The operands can be selected from the acquisition memory, the temporary waveform registers, or the waveform memories.
One operand is used for invert, integrate, or filter.
In the WAVEFORM function the result can be seen.

FUNCTION MUL ◆
In the FUNCTION pop-up menu, the mathematic functions are selected. The functions **ADD**, **SUBTRACT**, and **MULTIPLY** need two operands (SOURCE 1 and 2). The functions **INVERT**,

INTEGRATE, and **FILTER** need one operand (SOURCE 1). The selected function is turned off or on with the fifth softkey.

NOTE
In function FILTER the -3 dB frequency is $\frac{0.8}{time}$

SOURCE 1 A ⬍ In the SOURCE 1 pop-up menu, the first operand is selected. The source can be the acquisition memory, the temporary waveform registers, or the waveform memories.

SOURCE 2 A ⬍ In the SOURCE 2 pop-up menu the second operand is selected. The source can be the acquisition memory, the temporary waveform registers, or the waveform memories.

DESTIN 4 ⬍ In the DESTINATION pop-up menu, the result destination waveform memory is selected.

START MULTIPLY Selected mathematic function on/off.

⬍ SCALE The △ ▽ Up Down keys are used to select the SCALE factor of the selected mathematical function. The scale factors are 1, 5, 25, and 125.

Use the △ ▽ Up Down keys scale to keep math calculation result on the screen.

SETUP (Model 97)

In the SETUP mode, instrument settings can be saved, recalled, and deleted.

The setups are divided into three groups:

1. **Instrument setups** (settings) that are saved in 10 setup memories. These instrument settings are recalled via the setup mode.
2. **Initial setup**. The selected items in the initial setup pop-up menu will be used at turn on of the ScopeMeter. A master reset destroys these selected items and sets the inital setup to its default settings.
3. **Autoset setup**. The selected items in the autoset setup pop-up menu will be used when the AUTOSET mode is switched on. A master reset destroys the new selected items and sets the autoset setup to its default settings.

RECALL ⬍ The RECALL pop-up menu recalls a saved instrument setup from a selected setup memory. The recall pop-up menu can be turned on only if a setup has been saved. Step through the active items with the △ ▽ select/adjust keys.

SAVE ⬍ In the SAVE pop-up menu, present instrument settings are saved into a selected setup memory.

DELETE ◆◆ In the delete pop-up menu a saved instrument setup is deleted from a selected setup memory. The delete pop-up menu can be turned on only if a setup has been saved.

INITIAL SETUP ◆◆ In the INITIAL SETUP pop-up menu the items that are used for at power-on are selected. The items are divided into two groups:

1. AUTOSET used for the way the AUTOSET key acts at turn on.

The items are:
- ■ **ONLY AMPLITUDE**
- **ONLY TIME**
- **TIME & AMPLITUDE**

2. SCOPE SETTINGS

The items are:
- ■ **TRACE IDENTIFICATION**
- ■ **TRIGGER IDENTIFICATION**
- ■ **CLEAR at RUN**

3. SCOPE RECORD refresh times.

The items are:
- ■ **INFINITE**
- **2 seconds or 2 acquisitions**
- **5 seconds or 5 acquisitions**
- **10 seconds or 10 acquisitions**
- **60 seconds or 60 acquisitions**

■ = Default settings

AUTO SET ◆◆ In the AUTOSET pop-up menu, the autoset items are selected.

The items are divided into four groups.

1. AUTO SET source.

The items are:
- ■ **COMPLETE**
- **AS INTIAL SETUP**

2. Trigger functions.

The items are:
- ■ **50% LEVEL**
- ■ **DELAY OFF**
- ■ **POSITIVE SLOPE**
- **EXCLUDE EXTERNAL TRIGGER**

3. A&B channel setup

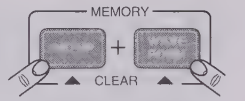
The items are:
- ■ **SEPARATE**
- ■ **NO AVERAGE**
- ■ **COUPLING AC**

4. General functions.

The items that are turned off:
- ■ **X-MOVE**
- ■ **Y-MOVE**
- ■ **A versus B (A= ↑ , B= →)**
- **CURSORS**
- **DOT JOIN**
- ■ **MATHEMATICS**
- **GENERATOR**

■ = Default settings

MEMORY CLEAR (Model 97)



In the MEMORY CLEAR mode the ALL SETUP and/or ALL WAVEFORM memories can be cleared.
Master Reset will also clear WAVEFORM and SETUP memories.

SPECIAL FUNCTIONS (Model 97)

The following special functions are available in the SPECIAL FUNCTIONS mode:
GENERATE to use the ScopeMeter as a signal generator.
MEASURE to use the ScopeMeter as a special predefined measuring tool for components.
PRINT FORMAT to set the waveform that should be printed.
PRINT SETUP for printer setup.
START PRINT.

GENERATE ▲▼ The signals that are output via the banana jacks are selected in the GENERATE pop-up menu.
The output possibilities are:

SIGNAL	FREQUENCY
5V Square wave	**1.95 kHz 976 Hz 488 Hz**
1V Sine wave	**976 Hz**
4V or 3 mA Slow ramp	**Voltage or Current**

The generator is automatically disabled if the mV⎓ , Ω, ⊣⊢ functions are active.

The generator output also can be selected as trigger source in the TRIGGER mode.

MEASURE ▲▼ In the MEASURE pop-up menu, the ScopeMeter is set in default settings to measure components.

COMPONENTS The ScopeMeter is set to test components. The GENERATOR OUTput banana jacks output a slow voltage or current ramp. The component to be tested should be connected to the banana jacks. Measure the component via channel A of the ScopeMeter. The characteristics of the component to be tested are shown.

The AUTOSET function does not apply for the components measurements mode.

PRINT FORMAT ▲▼ The waveform that needs to be printed is defined in the PRINT FORMAT pop-up menu.

The pop-up menu has three main groups:
1. ■ **SCREEN** for a direct screen print in graphics.
2. Data LOGging readings to set the CURSOR DATA reading repeat time.

The items are: **SINGLE**
2 seconds INTERVAL
5 seconds INTERVAL
10 seconds INTERVAL
60 seconds INTERVAL

3. WAVEFORM to print out the waveform points in a numerical format.

The items are:
Channel A
Channel B
A +/- B
Temporary register 1
Temporary register 2
Temporary register 3
Memory 4
Memory 5
Memory 6
Memory 7
Memory 8

PRINTER SETUP ◆ The printer type and baudrate is defined in the PRINTER SETUP pop-up menu.
The pop-up menu has two main groups:
1. Printer type setting for:
   - ■ **FX/LQ graphic**
   - **ThinkJet**

2. Baudrate setting to:
   - **9600 Baud**
   - ■ **1200 Baud**

■ = Default setting

START PRINT Start the print action via the serial RS-232-C port of the ScopeMeter with the setting that were made in the PRINT FORMAT and the PRINTER SETTING pop-up menu. To avoid printout errors, first set the ScopeMeter in the HOLD mode, except in the cursor data logging function.

5.6 POWER ON or LIQUID CRYSTAL DISPLAY

At power on or after you press the LCD key, the ScopeMeter starts in the LCD menu. The following modes are available in the LCD menu:

CONTRAST Used for LCD contrast adjustment. Use the △ and ▽ select/adjust keys for adjustment.

PROBE CAL ◆ The probes and calibrations are selected in the PROBE CALibration pop-up menu.
For detailed description see "PROBE DC CALIBRATION AND AC ADJUSTMENT PROCEDURES" in Section 4.

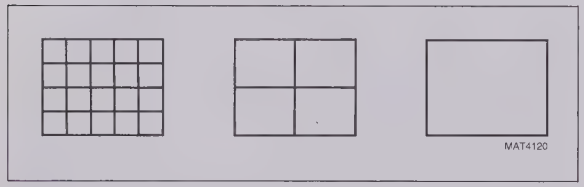
PICTURE ◆ The display parameters are selected in the picture pop-up menu. Use the △ and the ▽ select/adjust keys to select the parameter.

DOT JOIN Connects measured points.

DOTSIZE 1,2,3 Controls the vertical size of the trace (Scope and Meter) dots to increase the visibility.

LCD:REVERSE Reverses the picture in the ScopeMeter display to positive video.

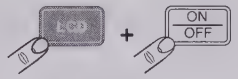
GRID ▲▼ The Scope display grid **FULL, QUADRANT** or **BORDER** is selected in the GRID pop-up menu.



BACK LIGHT (Model 97) Switches on/off the backlight.

UNDO (Model 97)

Setups can be corrected by pressing UNDO. Undo allows you to stepback 10 setups. Any present pop-up menu disappears first.

MASTER RESET 

Turn off the ScopeMeter.

Hold down the LCD key and press the ON/OFF key.

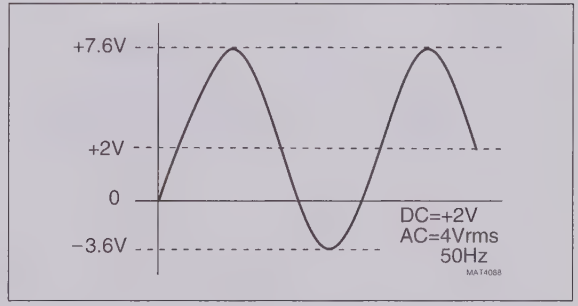
A master reset destroys all setups and memories and sets the ScopeMeter to the METER mode.

The following paragraphs discusses some common applications for your ScopeMeter and give you some points to consider when taking measurements.

OVERVIEW OF APPLICATIONS

1. Measuring Voltage (ACV ∿ or DCV ⎓)
2. Measuring Resistance
3. Testing Diodes
4. Continuity Testing
5. Using the Scope Trace Display in the Meter Mode
6. Measuring the Frequency of a repetitive signal
7. Looking at the Details
8. Using the Printer

6.1 MEASURING VOLTAGE (AC/DC)



To measure voltage, connect the ScopeMeter in parallel with the load or the circuit under test. Depending on the level of the measured voltage, a different ScopeMeter input may be used:

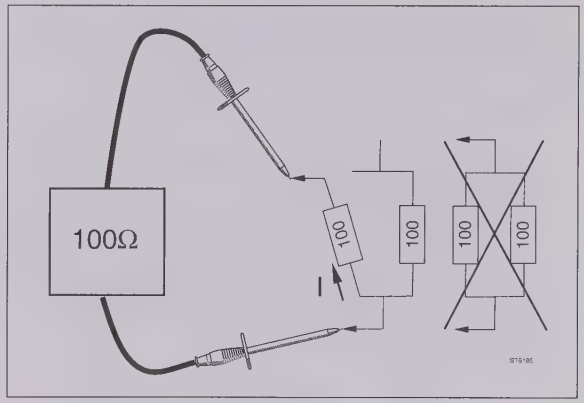
Use the RED 10:1 scope probe and channel A (BNC) for voltages from 600V rms down to the 3.000V range. Use the channel A (BNC) input direct or the low voltage dual banana jack inputs for dc voltages from 1 mV to 3.000V.

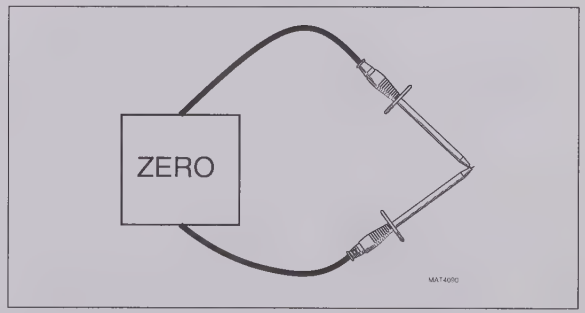
The channel A (BNC) has an input impedance of 10 MΩ in parallel with less than 15 pF via the RED Scope probe. The Low Voltage banana jack input has an input impedance of 1 MΩ in parallel with 25 pF.

6.2 MEASURING RESISTANCE

CAUTION
Turn off power on the test circuit and discharge all capacitors before attempting in-circuit resistance measurements. If an external voltage is present across a component, it will be impossible to take an accurate measurement of the resistance of that component.

Connect the unknown resistor to the banana jack inputs of the ScopeMeter.
The ScopeMeter measures resistance by passing a known current through the external circuit or component, measuring the voltage drop, and calculating the resistance using Ohm's Law (Ω=V/A). Remember the resistance displayed by the meter is the total resistance through all possible paths between the probes (also the resistance in the leads). This explains why in-circuit measurements of resistors often do not yield the ohms value indicated by the resistors color code.
The resistance in the leads can diminish accuracy on the lowest (300Ω) range. The error is usually 0.1 to 0.2Ω for a standard pair of test leads. To determine the error, short the test leads together and read the resistance of the leads. Use the ZERO (Relative Δ) function to automatically subtract the lead resistance from the resistance measurements.

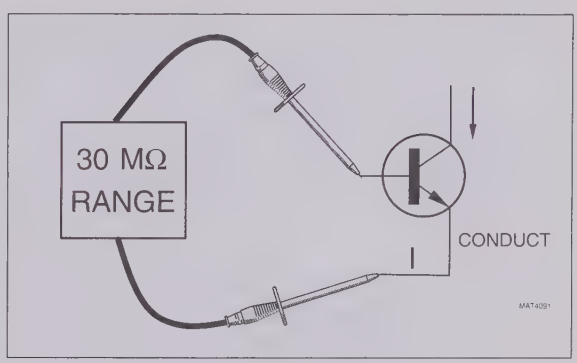




Most in-circuit resistance measurements can be made without removing diodes and transistors from the circuit. The full-scale measurement voltage produced on ranges below 30 MΩ does not forward-bias silicon diodes or

transistor junctions enough to cause them to conduct. Use the highest range you can (except 30 MΩ) to minimize the possibility of turning on diodes or transistor junctions. The full scale measurement voltage in the 30 MΩ range does forward-bias a diode or transistor enough to cause it to conduct.

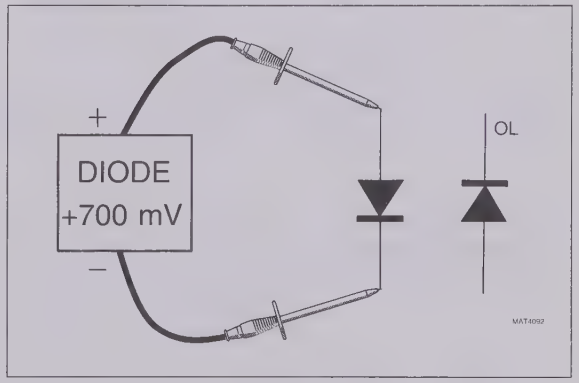
NOTE
In function diode and resistance, the black COMmon banana jack is not connected to the common of the scope BNC input channels A and B

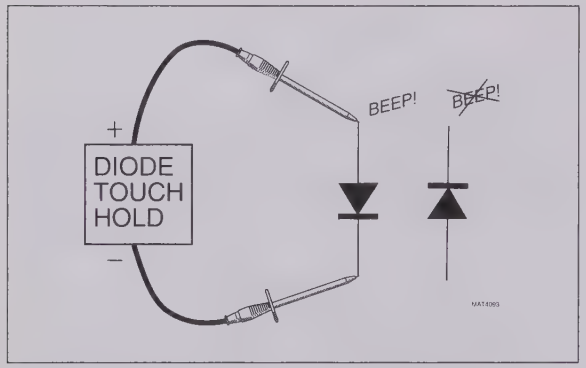


6.3 TESTING DIODES

Connect the diode to the banana jack inputs of the ScopeMeter. In diode test, a voltage is developed across components by a test current (approximately 0.5 mA with the test leads shorted) from the ScopeMeter. The voltage is read on a single 0 to +2.800V range that can measure up to four silicon diode or transistor junctions in series. For a silicon diode, the typical forward voltage should be about 0.7V. Voltages greater than 2.800V or open test leads produce an overload (OL) reading.

If the digital reading is the same in both directions, the diode junction is probably shorted. If the display reads OL in both directions, the diode junction is probably open. To protect sensitive devices, the open test lead voltage from the ScopeMeter does not exceed 4V.

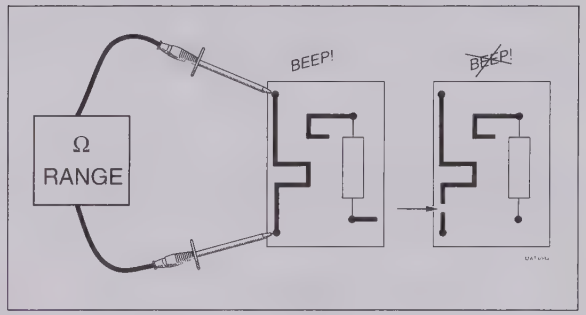




Use the Touch Hold mode to make audible diode tests. When the test leads are placed across the diode, a good diode or transistor junction will cause the meter to beep in the forward-biased direction and remain silent in the reverse-biased direction. A shorted diode junction will cause a beep in both directions. If an open is detected, the ScopeMeter will remain silent in both directions.

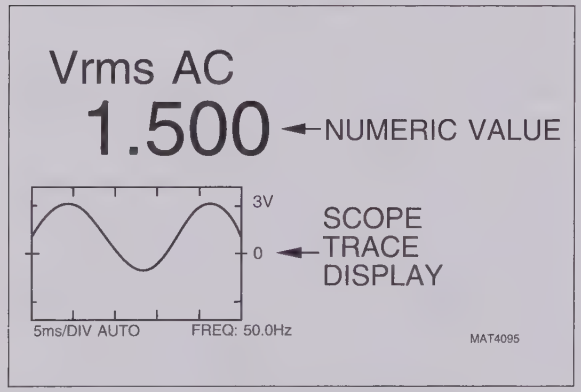
NOTE
In function diode and resistance the black COMmon banana jack is not connected to the common of the scope BNC input channels A and B.

6.4 CONTINUITY TESTING



Connect the device to be tested to the banana inputs of the ScopeMeter.
Continuity testing verifies that circuit connections are intact. The continuity function can be used to detect either shorts or opens. A short between 0 and 15Ω will generate a beeper tone. A measured resistance that is larger than 15Ω stops the beeper. The continuity function can be a valuable troubleshooting aid when looking for intermittent connections associated with cables, connectors, switches, relays, etc.
The beeper is turned off with ALERT))) in the DISPLAY MODES pop-up menu.

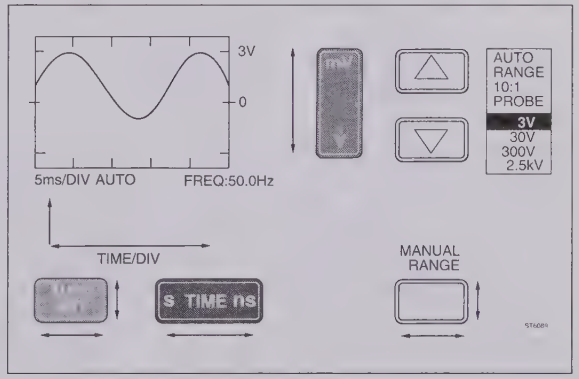
6.5 USING THE SCOPE TRACE DISPLAY IN THE METER MODE



In some situations an extra analog (graphical) representation of the measured signal will give more information than only the digital (numerical) value. This, for instance, can be the case with rapidly fluctuating signals, like noisy signals. Also measurement signals that show a slow variation in time (trend measurements) will be much easier using an analog display.
For this purpose the ScopeMeter has a special scope trace display that is used in METER mode. This display can be used with ac and dc measurements as well as with diode or resistance measurements.

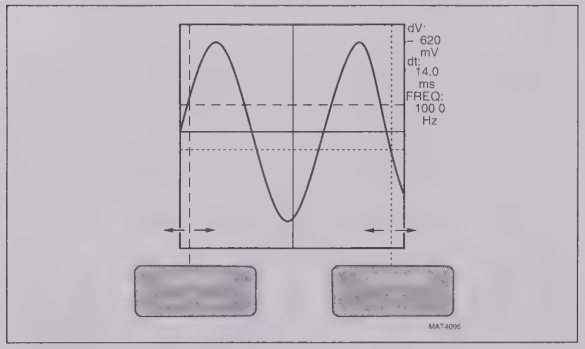
When the ScopeMeter is set to ac or (mV) dc voltage mode, the auxiliary scope display is shown automatically on the LCD. In these modes the frequency of the measured signal is calculated, if possible, and shown on the display. If the diode or resistance function is used, the scope trace display can always be recalled via the DISPLAY MODES pop-up menu. Select TRACE DISP. to turn it on or off.

NOTE
The scope trace display is only intended to get a visual representation of the signal measured. If the waveform of the signal must be examined in more detail, it is recommended that you switch the ScopeMeter into SCOPE mode.



6.6 MEASURING THE FREQUENCY OF A REPETITIVE SIGNAL IN SCOPE MODE

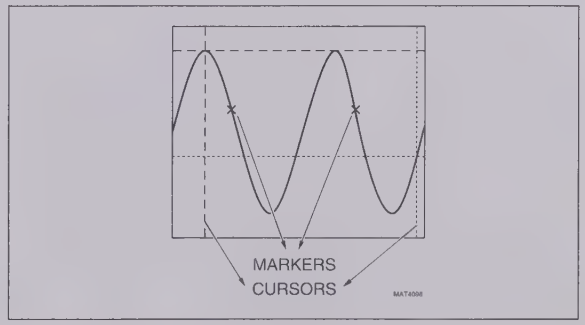
In the following text the measurement of the frequency of a sine wave signal is described. The method used works only with the 95 and 97 ScopeMeter models because cursors are used.



Connect the signal to be measured to the channel A (BNC) input of the ScopeMeter. Select SCOPE mode. Set the attenuator, timebase, and triggering to suitable values, or press the AUTOSET key. To measure the frequency of the signal displayed, press the CURSOR DATA key to get to the CURSOR DATA menu. Now press the CURSOR softkey to turn on the cursors. The cursors are displayed as vertical differently dashed lines that track the trace. The places where the cursor lines cross the trace are shown by means of horizontal differently dashed lines. You can position the cursors to the left and to the right with the cursor positioning keys. Cursor 1 and cursor 2 are not allowed to pass each other to avoid erroneous negative time readings.

The distance between the cursors is displayed on the right side next to the trace as a delta V and delta t value (default measurement functions). Position the cursors so that at least 1.5 signal period is present between them.

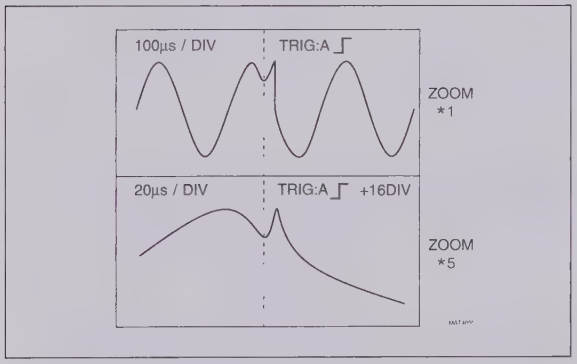
To activate the frequency measurement function, press the FUNCTION softkey, and select FREQUENCY from the pop-up menu. Now the measured FREQUENCY is displayed right next to the trace. Press the "MARK on X" softkey and select FREQUENCY. Two markers are placed on the waveform between the cursors. Their position is used to indicate where on the waveform the selected automatic measurement is being calculated.



6.7 LOOKING AT THE DETAILS

How to get a closer look at a part of a signal:

ZOOM

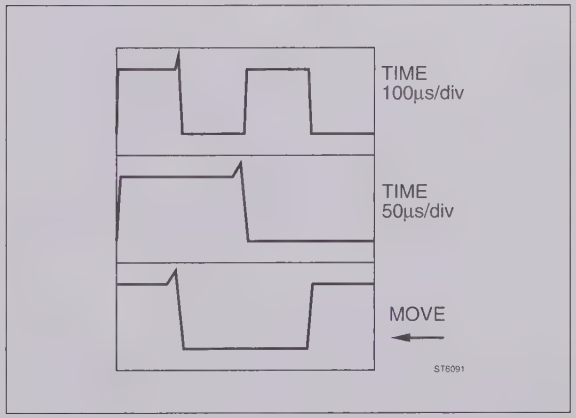


Apply the signal to be examined to the channel A (BNC) input. Now turn on the SCOPE mode, and use the [△] [▽] Up Down keys to ZOOM in or out. Basically the ZOOM function will zoom in or out on the part of the signal that is around the fourth division of the LCD. Each time a select/adjust key is pressed, the timebase will be changed one step and the trigger delay will be recalculated. This is done in such a way that the signal detail of the fourth division will be on screen after a new acquisition has been made.

The ZOOM function will work in both recurrent and single mode.
In single mode the new positions for timebase and trigger delay will be set, after which a new acquisition can be made by pressing the HOLD/RUN key.

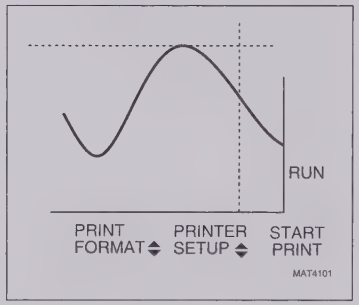
TIMEBASE

In the timebase function, the signal can be expanded and moved on the first vertical grid line. Press the **s TIME ns** key to expand the signal. Press the **MOVE** key to move the signal to the left or right. TIME causes a trigger delay if the trace is not on the first grid line.



6.8 USING THE PRINTER (Model 97)

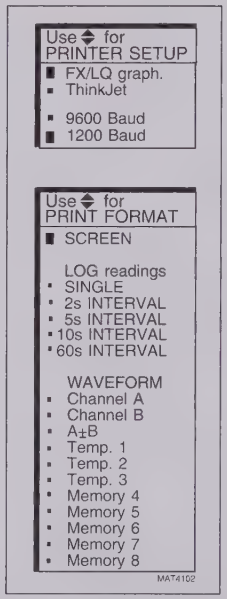
The following application note requires a Model 97 ScopeMeter , an Optically Isolated RS-232-C interface and an Epson FX/LQ printer (or compatible) or HP ThinkJet printer (or compatible).



The Model 97 ScopeMeter can be used to make a hard copy of the information on the LCD or in one of the trace memories. Make sure that the optically isolated interface PM9080/001 is connected correctly to the ScopeMeter and the printer and turn the printer, and the ScopeMeter on. (Refer to the manual delivered with the optical interface.) The printout option can be operated completely from the SPECIAL FUNCTion menu. You can reach this menu from both SCOPE and METER mode by pressing the SPECIAL FUNCT key.

Printing is done in three steps:

First, set up the printer parameters. Press the PRINTER SETUP softkey to select a pop-up menu, in which the printer type (FX/LQ graph. or ThinkJet)



and the baudrate (9600 Baud or 1200 Baud) can be set. Choose the appropriate values for your printer

Fixed parameters are:
8 databits, 1 stopbit, no parity, handshake XON/XOFF

Now press the PRINT FORMAT softkey. The information sent to the printer can be chosen from the pop-up menu. Choose "SCREEN" for a graphic printout of the actual display, "LOG readings" for the results of the automatic measurements, or one of the WAVEFORM choices for a numerical representation of the data acquired by the ScopeMeter.

Finally press the START PRINT softkey. The ScopeMeter display will flash for an instant, and printing will start. Printing can be stopped at any time by pressing the START PRINT softkey once more.

NOTE Press the HOLD key before pressing START PRINT, except in the cursor data logging function, to avoid printout errors.

7.1 GENERAL INFORMATION

The operation verification verifies the ScopeMeter operation with a minimum of test steps and actions. It is assumed that the operator doing the test is familiar with oscilloscopes and multimeters and their characteristics. A complete ScopeMeter Performance Verification Procedure is published in the service manual. (Refer to "HOW TO ORDER THE SERVICE MANUAL" at the front of this manual).

WARNING
BEFORE TURNING ON THE SCOPEMETER, ENSURE THAT IT HAS BEEN INSTALLED IN ACCORDANCE WITH THE INSTALLATION INSTRUCTIONS.

NOTE
The procedure does not check every facet of the ScopeMeter's characteristics; rather, it is concerned primarily with those parts of the instrument that are essential to measurement accuracy and correct operation.

For operation verification purposes, the ScopeMeter generates a 1.95 kHz 5V p-p square wave signal can be measured and verified. The generated signal is measured by the Scope and Meter.
To use the ScopeMeter to its full capability, it is essential to use only calibrated probes on your instrument. These calibrated probes are delivered with the ScopeMeter (Refer to "PROBE ADJUSTMENT AND CALIBRATION" in Section 4).

7.2 HOW TO ENTER THE OPERATION VERIFICATION

1. Turn **ON** the ScopeMeter.
2. Connect the **RED 10:1 SCOPE PROBE** to channel **A (RED BNC)** input.
3. Connect the RED **ADJUST ADAPTER** to the RED banana **GENERATOR OUT**put.
4. Connect the **RED PROBE** to the RED **ADJUST ADAPTER**.
5. Press the **SCOPE** key.
6. Press the **LCD/CAL** key.
7. Press the **PROBE CAL** softkey to select the CALibration & ADJUST pop-up menu.
8. Press the △ or ▽ select/adjust keys to select AC ADJUST of channel A.
9. Press the **ENTER** softkey to enter the AC ADJUST mode.

NOTE
Make sure that the probe adjustments and calibration is a part of the operation verification procedure (Refer to Section 4).

SCOPE VERIFICATION

- Check the SCOPE display on the following settings and results:

Channel Configuration	Channel A
Vertical Amplitude	1V/division
Channel Input Coupling	DC
Probe Selected	PROBE 10:1
Time Base	100 µs/DIV
Trigger Mode (Press **SCOPE** key)	Recurrent
Trigger Source (Press **TRIGGER** key)	Channel A
Trigger Slope (Press **TRIGGER** key)	+ Slope
Result	Square wave 1.95 kHz ±1%, 5V p-p ±10%

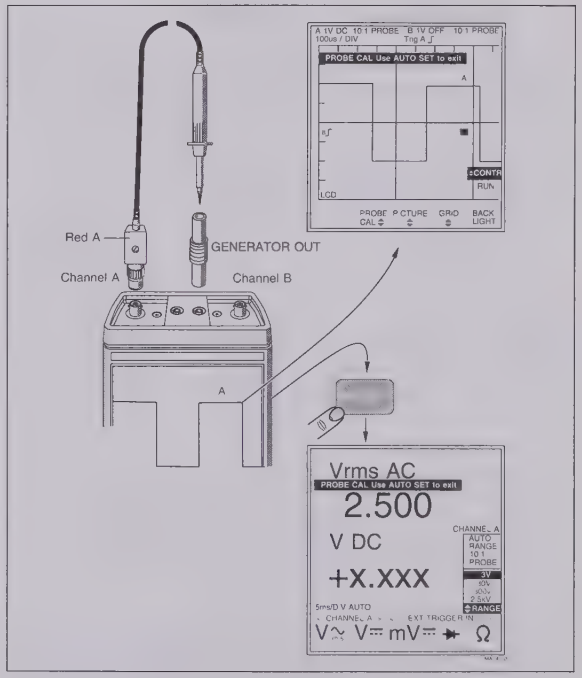
10. Press the METER key.
    The ScopeMeter sets itself to the initial METER measurement function.

METER VERIFICATION

- Check the METER display on the following settings and results:

Result	Vrms AC 2.500 ±10%
Ranging	AUTO, 3V

11. Press the AUTOSET key to end the operation verification procedure.



To verify the scope operation of channel B, proceed in the same order as Channel A; however, use the GREY channel B BNC socket and the GREY scope probe. Channel B does not have METER mode.

8.1 MAINTENANCE

Repairs or servicing not covered in this manual should be performed only by qualified personnel as described in the Service Manual for ScopeMeter Models 93, 95, and 97 (order number 4822 872 05346).

8.2 PREVENTIVE MAINTENANCE

Periodically wipe the case and the display with a damp cloth and detergent. Do not use abrasives, solvents or alcohol.

8.3 CALIBRATION

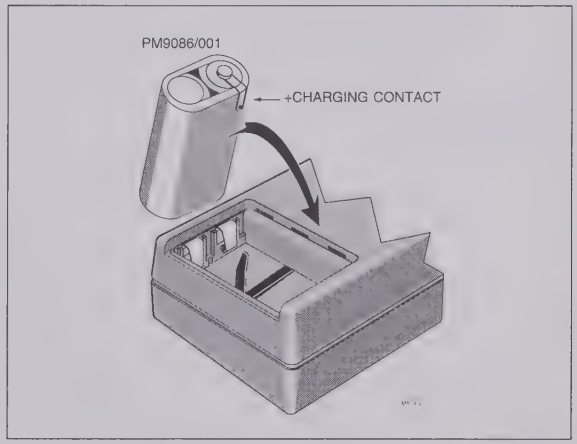
Calibrate your ScopeMeter once a year to ensure that it performs according to its specifications. Contact the nearest Service Center, or refer to the ScopeMeter Service Manual for calibration and verification procedures. For replacement parts, see the parts list in Section 9.

8.4 BATTERY REPLACEMENT

WARNING
TO AVOID ELECTRICAL SHOCK, REMOVE THE TEST LEADS, PROBES, AND BATTERY CHARGER BEFORE REPLACING THE BATTERIES.

The ScopeMeter is powered by a pack of four NiCad batteries (type number PM9086/001) that is delivered with the ScopeMeter. Four Alkaline C-Cell batteries can also be used, type KR27/50 or R14. Refer to the following illustrations and use the following procedure for replacement:

1. Disconnect the test leads, probes, and battery charger from any live source and from the ScopeMeter itself.
2. The battery cover is secured to the Scopemeter with two screws. Use a screwdriver to loosen the two screws.
3. Lift the battery cover from the ScopeMeter.



4. Lift the NiCad Battery Pack or loose batteries from the battery compartment.
5. Reinstall the new NiCad Battery Pack or the new loose batteries into the battery compartment, taking care to place the NiCad Battery Pack in the correct position.

NOTE
The NiCad Battery Pack PM9086/001 has a charging contact that must be positioned on the charging contact in the battery compartment.

6. Reinstall the battery cover and secure the two screws.

8.5 FUSE REPLACEMENT

The ScopeMeter is electronically protected. There is no internal fuse present.

8.6 SERVICE

If the ScopeMeter fails, check the battery and replace or recharge it as needed. If the ScopeMeter still does not work properly, review this manual to make sure you are replacing or recharging the batteries correctly. If the ScopeMeter still malfunctions, pack it **and the RED and GREY scope probe** securely in the original shipping container and forward it, postage paid, to the nearest Service Center. Include a description of the malfunction. Fluke/Philips assumes NO responsibility for damage in transit.

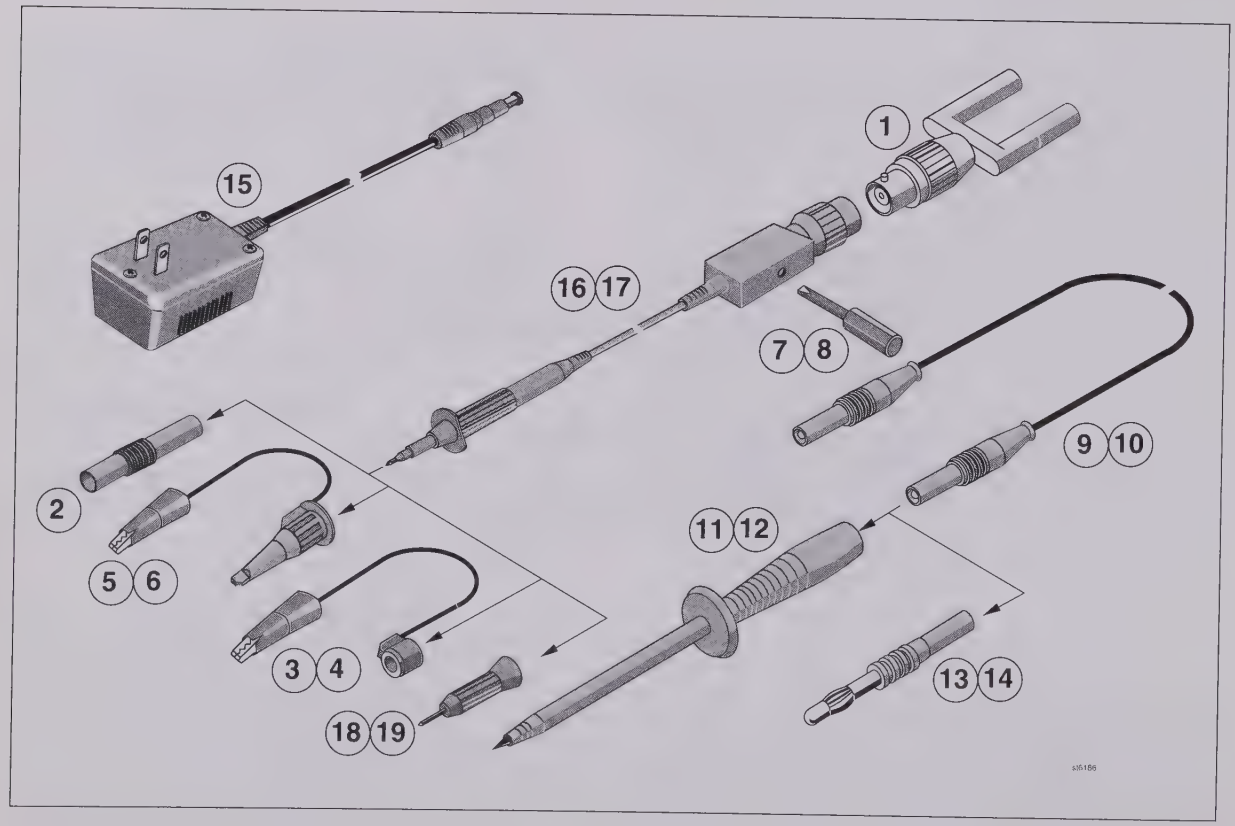
A ScopeMeter under warranty will be promptly repaired and returned at no charge. If the warranty has elapsed, the ScopeMeter will be repaired and returned for a fee. Contact the nearest Service Center for information and prices. A list of U.S. and international service center locations is at the back of this manual.

NOTE

When servicing the ScopeMeter, use only the replacement parts specified

The replacement parts are shown in the following figure and listed in the following table. To order, contact the nearest Service Center.

ORDER NUMBER /MODEL NUMBER	DESCRIPTION	ITEM
PM9086/001	NiCad Battery Pack	-
PM8907/003	Line Voltage Adapter/Battery Charger (North America)	15
PM8918/002	Safety-Designed ScopeMeter Probe Set	16, 17, 18, 19, 3, 4, 7, 8,
PM9081/001	Safety-Designed Dual Banana Plug to Female BNC Adapter	1
PM9083/001	ScopeMeter Yellow Protective Holster	-
C75	Accessory Case	-
Fluke 916015	Multimeter Test Lead Set	9, 10, 11, 12, 13, 14,
Fluke 916010	ProbeTip to Banana Plug Adapter/Adjust adapter	2
Fluke 916127	Quick Operating Guide	-
Fluke 916119	ScopeMeter English Users Manual	-
Fluke 916122	ScopeMeter French, Spanish, Italian Users Manual	-
Fluke 915970	Service Manual	-


15
1
16 17
7 8
2
9 10
5 6
11 12
3 4
13 14
18 19

10.1 Introduction

A. Performance Characteristics
- PHILIPS and FLUKE guarantee the properties expressed in numerical values with stated tolerance. Specified non-tolerance numerical values indicate those that could be nominally expected from the mean of a range of identical instruments.
- For definitions of terms, reference is made to IEC Publication 351-1.

B. Safety Characteristics
This instrument has been designed and tested in accordance with IEC Publication 348, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. This manual contains information and warnings that must be followed by the user to ensure safe operation and to keep the instrument in a safe condition.

Contents:

1 Introduction
2 Display
3 Oscilloscope
Vertical system
Horizontal system
Trigger
Setup memories
Waveform memories
Mathematics
Cursors
Autoset
4 Multimeter
5 Generator
6 Undo
7 Input terminals
8 External power requirements
9 Internal batteries
10 Environmental data
11 Mechanical data
12 Accessories

10.2 Display

The display used is of the LCD type Super Twisted Nematic. The rectangular active area of 240x240 pixels has a diagonal of 4.7 inches (12 cm). The trace area is 200x240 pixels. A graticule with 25 pixels per division can be chosen with softkey control.
- Model 97 has an Electro Luminescence backlight.
- The CONTRAST ratio is adjustable in the LCD menu.

10.3 OSCILLOSCOPE

Vertical system

Deflection Factor

Models 95 and 97: 1 mV per division to 100V per division in 1-2-5 sequence, for timebase 60s to 1µs/division.
Model 93: 5 mV per division to 100V per division in 1-2-5 sequence.
This can be expanded a factor of 10 with the delivered 10 to 1 safety designed probe.

Vertical Resolution

8 bits, 25 levels per division.

DC Accuracy

± 2%

Rise Time

Vertical amplifier response limits the rise time to 7 ns. For time base settings slower than 200 ns the rise time is smaller than the sample distance, so the measured rise time is unreliable if it is smaller than $\frac{2 \times s/div}{25}$

Bandwidth

> 50 MHz (-3 dB)

Nonlinearity
±(2% ± 1 digit)Including Analog to Digital Converter, which will have no missing codes and is monotonic.

Move Control Range
+4 divisions and -4 divisions

DC Balance
The base line is automatically readjusted after switching the attenuator or ac/dc/ground.

Min/Max (Models 95 and 97 only)
Acquisition mode at 1 µs per division or slower on Channel A only.
Pulse width for 100% probability of detection is 40 ns.

Average (Models 95 and 97 only)
The running average can be set to 256 maximum.
In Roll this is 10 fixed.

Zoom (Models 95 and 97 only)
Zoom offers the possibility to zoom in or out around the 4th division, within the limits of the timebase and the maximum delay.

Horizontal system

Range
5s per div up to 10 ns per division with triggered start.
The ROLL mode is active from 60s per division up to 10s per division.
Single shots are possible from 5s per division upto 100 ns per div; for timebase settings faster than 1 µs per division an automatic interpolation takes place. The useful bandwidth is about 6 MHz.
For timebase settings of 50 µs or slower, the Channels are chopped; for settings of 20 µs or faster, the Channels are alternated, so Channel A is displayed first and, after a second trigger pulse, Channel B is displayed.

Accuracy
± 0.1% ± 1 LSB

Sample Frequency
Dependent on timebase: $\frac{25}{\text{s/div}}$ Hz (maximum 25 MHz)
In Min/Max mode (Models 95 and 97 only): 25 MHz

Record Length
512 samples calibrated for 25 samples per division
CAPTURE gives the possibility to select a record length of 10 divisions or 20 divisions.

Move Control
+4 divisions up to -16.5 divisions

A versus B
Channel A is displayed along the vertical axis, and Channel B along the horizontal axis. The timebase is set manually.

TRIGGER

Internal Sensitivity
<0.5 div for frequencies lower than 10 MHz.
Models 95 and 97 have an extra amplification in the vertical system to create 2 mV and 1 mV per division. That is not valid for the trigger, so the sensitivity decreases in 2 mV and 1 mV with a factor of 5.

Level Range
+4 divisions and -4 divisions

External
TTL compatible. Selectable for use with or without 10:1 probe.
Trigger level is indicated in the screen.

Delay Range
-20 up to 640 divisions in delay time mode.
1 up to 1023 in EVENTS delay mode (Models 95 and 97 only).
In N_CYCLE mode, the trigger frequency is divided by a number N, ranging 2 to 255 (Models 95 and 97 only).

SETUP MEMORIES (Model 97 only)

Memory Size

Maximum 10 SETUPS. The possible functions to manipulate the settings are: save, delete, recall, next, or previous.

WAVEFORM MEMORIES (Models 95 and 97 only)

For waveform storage, eight extra memories are available. In Model 97 the memories can be cleared all together.
Each memory contains 512 words for waveform and the setup belonging to this waveform.

MATHEMATICS (Model 97 only)

On the waveforms mathematics can be executed, such as multiplication, add, subtract and filter, invert and integrate. The result is stored in a selected memory.

CURSORS (Models 95 and 97 only)

With the aid of the CURSORS, the following measurements can be executed on the selected waveform between the cursors:
- dV, dT, 1/dT, RMS, mean, maximum, minimum, peak to peak, rise or fall time, frequency, and phase.
- The time between trigger and cursor.
- ratio

A maximum of five results can be displayed at the right hand side of the display.

AUTOSET

Autoset automatically sets the vertical deflection, the horizontal time base, and the trigger selection.
Model 97 offers the possibility to configurate the autoset. As clusters can be choosen, ONLY AMPLITUDE, ONLY TIME or TIME & AMPLITUDE, so the trigger is not affected. In the set_up for the auto set the following functions can be changed (the underlined is the default setting and, consequently, the setup for Models 93 and 95):

Vertical:	
MOVE	zero, or not affected
Input Coupling	ac, or not affected
A versus B	OFF, or not affected
Average	OFF, or not affected
Separate	Center of screen in one Channel display Channel A + 1 div and Channel B – 1 div dual Channel
Horizontal:	
MOVE	zero, or not affected
Triggering:	
Delay (>0)	OFF, or not affected
Delay (<0)	not affected
Include External	include external or A or B
Level	50% of signal, or not affected
Slope	positive, or not affected
Miscellaneous:	
Cursors	not affected, or OFF
Mathematics	OFF, or not affected
Generator	not affected, or OFF
Dot Join	not affected, or OFF

10.4 MULTIMETER

DC VOLT

Ranges	300 mV, 3V, 30V and 300V
Accuracy	± 0.5% ± 5 counts

AC VOLT

Ranges	300 mV, 3V, 30V and 250V
Accuracy	± 1% ± 10 counts 50 Hz to 60 Hz
	± 2% ± 15 counts 20 Hz to 20 kHz
	± 3% ± 20 counts 5 Hz to 1 MHz
	Additional error ± 1% ≥ 1 kHz

For <10 Hz with 10:1 probe or <100 Hz direct (1:1 probe), use function VAC+DC.
The probe, delivered with the instrument, will increase the Ranges by a factor of 10.
To create more accurate measurements on ac, or dc with large ac component, the timebase can be optimized by pressing AUTOSET, or changing the TIME setting.

mV DC

Ranges	300 mV and 3V
Accuracy	± 0.5% ± 5 counts

This range has a low pass filter with a bandwidth of 5 kHz

W

Ranges	300Ω, 3 kΩ, 30 kΩ, 300 kΩ, 3 MΩ and 30 MΩ.
Accuracy	± 0.5% ± 5 counts

Diode

Measuring Current	0.5 mA
Maximum Voltage	4V

If Output Voltage is higher than 2.8V the DISPLAY gives OL (OverLoad).

Display Functions

- Models 95 and 97 can display the results in dBm, dBV or audio Watt. The assumed load resistance can be chosen from: 1, 2, 4, 8, 16, 50, 60, 75, 93, 110, 125, 135, 150, 200, 250, 300, 500, 600, 800, 900, 1000 or 1200Ω, depending on the mode.
- The delta function displays the difference after 0% or delta is pressed.
- The frequency can be displayed.

Range	1 Hz ... 5 MHz
Accuracy	± 0.5%
Resolution	4 digits

- The display of the trace can be switched off.

Scale

Models 95 and 97 offer the possibility of setting 0% and 100%, to create a readout that is related to the function a+bx (then x is the measured value).

Touch Hold® Function

Can be activated by pressing HOLD.

RECORD

In METER mode:	The actual value is displayed simultaneously with the maximum, average, and minimum value.
In SCOPE mode:	All the measured values are displayed. In Model 97 a reset is possible every 2, 5, 10, or 60 seconds.

10.5 GENERATOR

The generator can be used for probe calibration.
The output impedance is typical 400Ω (In all Models).

Model 97

Square wave

amplitude 5V p-p typical

frequency is selectable at 488 Hz, 976 Hz or 1.95 kHz.

Sinewave

amplitude 1V p-p typical

frequency 976 Hz

Slow Ramp Current

range 0 to 3 mA; maximum voltage 2V.

Slow Ramp Voltage

range -2V to 2V; maximum current 1 mA.

10.6 UNDO (Model 97)

The front panel is set back to the previous setup. In this way it is possible to go back and undo a maximum of 10 setups.

10.7 INPUT TERMINALS

CHANNELS A, B and EXTERNAL TRIGGER

Impedance 1 MΩ // 25 pF

Voltage Maximum 300V up to 1 MHz. For higher frequency the maximum allowed voltage decreases 6 dB per octave.

The inputs are protected for line voltages of 600V and surge voltages of 4 kV.

Connectors Channels A and B have insulated BNC connectors. Two 4 mm banana jacks are used for external triggering, mV DC measurement, resistor measurement, diode testing, and generator output.

- The commons of all the inputs are connected together.
- The maximum input voltage between any terminal and earth ground is 600V.

10.8 EXTERNAL POWER REQUIREMENTS

Input Voltage range

From 8V to maximum 20V

WARNING
THE MINUS VOLTAGE IS CONNECTED TO COMMON. WHEN USING A NON DOUBLE INSULATED, POWER SUPPLY, CONNECT COMMON TO PROTECTIVE GROUNDING.

Power consumption

typical 5W

10.9 INTERNAL BATTERIES

With the pack of four NiCad batteries delivered with the instrument, the operating time is typical 4 hours. Charging time is typical 16 hours with the ScopeMeter not operating. Alkaline batteries C-Cell, KR27/50 or R-14 size can be used. The operating time is then also 4 hours.

Charging Current for NiCad Pack

100 mA with instrument ON

200 mA with instrument OFF

To avoid deterioration of the batteries, the maximum temperature during charging must not exceed 45 °C.

10.10 ENVIRONMENTAL DATA

The environmental data mentioned in this manual are based on the results of the manufacturer's verification procedures. Details on these procedures and failure criteria are supplied on request by the FLUKE/PHILIPS organization in your country, or by PHILIPS, INDUSTRIAL ELECTRONICS, EINDHOVEN, THE NETHERLANDS.

Meets requirements of MIL-T-28800D Type III Class 3, Style C, except for temperature range and power switch.

Operating Temperature	0 °C to 50 °C
Storage Temperature	-20 °C to 70 °C
Relative Humidity	90% from 20 °C to 30 °C 70% from 30 °C to 50 °C
Shock and Vibration	Per MIL-T-28800 for a Class 3 instrument.

10.11 MECHANICAL DATA

Size	60 mm x 129 mm x 262 mm (2.4 inch x 5.1 inch x 10.3 inch)
with holster	62 mm x 140 mm x 281 mm (2.5 inch x 5.5 inch x 11.1 inch)
Weight	1.5 kg (3.3 lbs)
with holster	1.8 kg (4.0 lbs)
Safety	Designed to protection Class II per IEC 348 and UL 1244 for 600V.
Sealing	Dust and splash proof

10.12 ACCESSORIES

Furnished with the instrument:

Users Manual including Operation Verification Procedure.

PM8918/002	2x 10 MΩ 10:1 passive Probe.	
	attenuation	x10
	Useful Bandwidth	50 MHz
	Input resistance	10 MΩ
	Input capacitance	15 pF
	Cable length	1.5m
	Max. signal Voltage	600V
	Max. surge Voltage	6 kV
	Max. Voltage to Ground	600V

Double insulated per IEC1010-1 for 600V.

PM9083/001	Holster
PM8907/00x	Power adapter/Battery Charger. Input Voltage dependent on version. Output cable double insulated per IEC1010-1 for 600V.
C 75	Accessory case.

Set of probe accessories.

Multimeter test lead set.

Quick Operating Guide, placed in holster

PM9086/001	NiCad Battery Pack, placed in battery compartment.

Northern California
Fremont, California
(1) (415) 651-5112

Southern California
Irvine, California
(1) (714) 863-9031

Denver
Aurora, Colorado
(1) (303) 695-1171

Orlando
Altamonte Springs, Florida
(1) (407) 331-2929

Chicago
Palatine, Illinois
(1) (708) 705-0500

Washington D.C.
Rockville, Maryland
(1) (301) 770-1576

Paramus
Paramus, New Jersey
(1) (201) 599-9500

Dallas
Carrollton, Texas
(1) (214) 406-1000

Seattle
Everett, Washington
(1) (206) 356-5560

OTHER COUNTRIES:

Buenos Aires, Argentina
Coasin S.A.
(54) (1) 552-5248

La Paz, Bolivia
Coasin Bolivia S.R.L.
(591) (2) 340-962 or 363-365

Sao Paulo, Brazil
ATP/Hi-Tek Electronica Ltda.
(55) (11) 421-5477

Mississauga, Ontario, Canada
Fluke Electronics Canada Inc.
(416) 890-7600

Santiago, Chile
Itronsa
(56) (2) 232-4308

Beijing, People's Republic of China
Fluke International Corp.
(86) (1) 512-3435

Bogota, Colombia
Sistemas E Instrumentation, Ltda.
(57) 287-5424

Quito, Ecuador
Proteco Coasin Cia., Ltda.
(593) (2) 230-283

Wanchai, Hong Kong
Schmidt & Co (H.K.), Ltd.
(852) (5) 833-0222

Tel Aviv, Israel
R.D.T. Electronics Engineering Ltd.
(972) (3) 548-3737

Tokyo, Japan
John Fluke Mfg. Co., Inc.
(81) (3) 3434-0181

Seoul, Korea
IL Myoung, Inc.
(82) (2) 552-8582-4

Selangor, Malaysia
Mecomb Malaysia Sdn. Bhd.
(60) (3) 774-3422

Colonia del Valle, Mexico
Mexicana de Electronica Industrial, S.A. (Mexel)
(52) (5) 682-8040

Lima, Peru
Importaciones y Representaciones Electronicas S.A.
(51) (14) 28-8650

Metro Manila, Philippines
Spark Radio & Electronics, Corp.
(63) (2) 700-621

Singapore, Republic of Singapore
Rank O'Connor's Singapore PTE Ltd.
(65) 473-7944

Taipei, Taiwan, R.O.C.
Schmidt Scientific Taiwan
(886) (2) 501-3468

Bangkok, Thailand
Measuretronix Ltd.
(66) (2) 375-2733-4

Montevideo, Uruguay
Coasin Uruguaya S.A.
(598) (2) 789-015

Caracas, Venezuela
Coasin C.A.
(58) (2) 241-03-09

FOR COUNTRIES NOT LISTED ABOVE:

Fluke International Corp.
PO Box 9090
Mail Stop 206A
Everett, WA 98206-9090
U.S.A.
Tel: (1) (206) 356-5500
Fax: (1) (206) 356-5116
Tlx: 185103 FLUKE UT

△ 3-3, 5-5
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Ω 3-3, 5-3, 6-2
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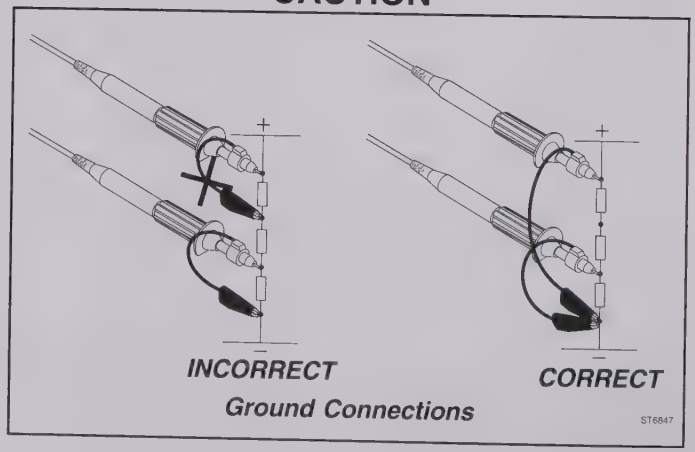
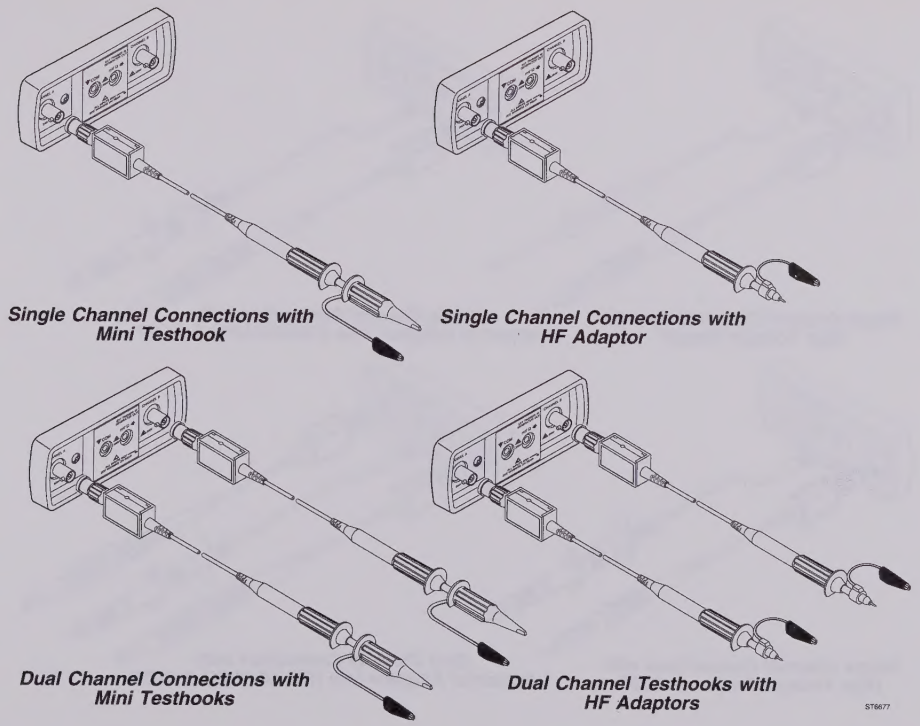
CAUTION




Single Channel Connections with Mini Testhook
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Dual Channel Connections with Mini Testhooks
Dual Channel Testhooks with HF Adaptors
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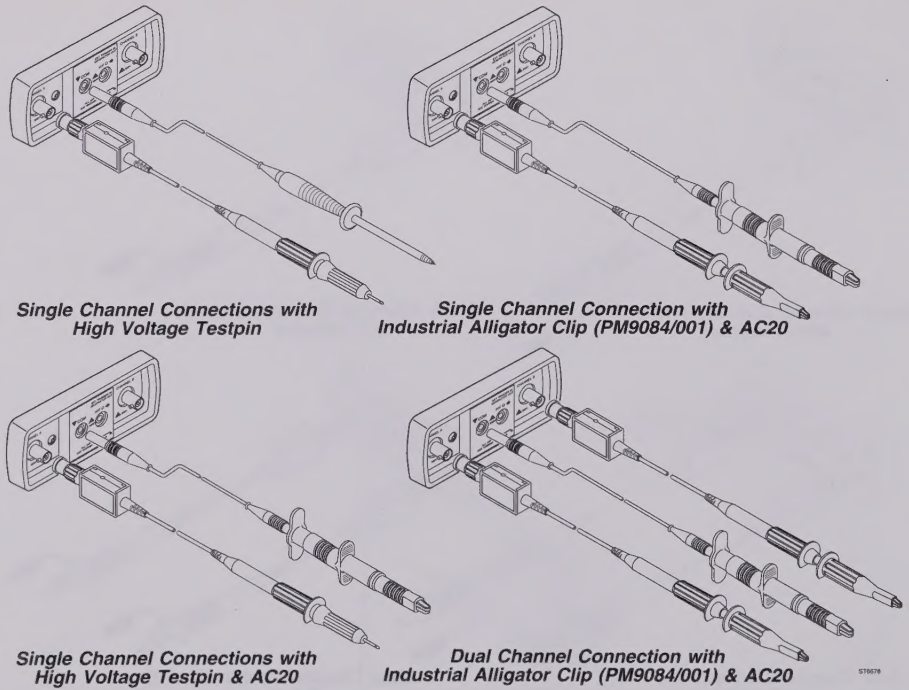
Input Connections for Grounded Electronic Measurements



Single Channel Connections with High Voltage Testpin

Single Channel Connection with Industrial Alligator Clip (PM9084/001) & AC20

Single Channel Connections with High Voltage Testpin & AC20

Dual Channel Connection with Industrial Alligator Clip (PM9084/001) & AC20

ST6678

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Input Connections for Isolated Ground Heavy Duty Industrial Measurements

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